United States Department of Agriculture

Apache-Sitgreaves National Forests Land Management Plan

Programmatic Final Environmental Impact Statement

Apache, Coconino, Greenlee, and Navajo Counties, Arizona

Volume I. Chapters 1 through 3

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Programmatic Final Environmental Impact Statement for the Apache-Sitgreaves National Forests Land Management Plan

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Apache, Coconino, Greenlee, and Navajo Counties, Arizona

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Abstract: To comply with the National Forest Management Act and address changes that have occurred over the past 27 years, the Apache-Sitgreaves National Forests propose to revise the current land management plan (1987 plan). This programmatic final environmental impact statement (FEIS) documents analysis of the impacts of four alternatives developed for programmatic management of the 2.1 million acres administered by the Apache-Sitgreaves National Forests.

The FEIS documents the analysis of all alternatives and the associated environmental consequences at a programmatic level. The preferred alternative (alternative B) analyzed in this FEIS and reflected in the accompanying "Apache-Sitgreaves National Forests Land Management Plan," would guide all natural resource management activities on the Apache-Sitgreaves National Forests. This alternative addresses new information and concerns received since the 1987 plan was published, and it meets objectives of Federal laws, regulations, and policies.

Summary

The Forest Service proposes to implement a new land management plan for the Apache-Sitgreaves National Forests (Apache-Sitgreaves NFs or the forests). The area affected by the proposal includes the approximately 2.1 million acres of National Forest System (NFS) lands known as the Apache-Sitgreaves NFs, located in Apache, Coconino, Greenlee, and Navajo Counties in Arizona. This proposal does not include Apache National Forest lands located in New Mexico; those lands are managed according to the Gila National Forest land management plan.

This action is needed because the National Forest Management Act of 1976 directs that land management plans be revised every 10 to 15 years; the current management direction for the forests under the 1987 Apache-Sitgreaves NFs plan (1987 plan) is 27 years old. It no longer addresses changes that have occurred to economic, social, and ecological conditions; new policies and priorities; and new information based on monitoring and scientific research. For example, invasive species are a current threat to forest health; they currently infest over 30,000 acres of the Apache-Sitgreaves NFs. At the time the 1987 plan was approved, invasive species were not a concern.

Extensive public involvement and collaboration on the revision of the 1987 plan preceded publication of this FEIS. Informal discussions with the public regarding needed changes to the 1987 plan began with a series of public meetings during the summer of 2006. From 2006 to 2014, multiple meetings, correspondence, news releases, comment periods, and other tools were utilized to gather feedback from the public, forest employees, tribes, Federal and State agencies, and local governments. As a culmination of these public involvement efforts, the forests have developed this programmatic final environmental impact statement (FEIS) to examine potential alternatives for a new land management plan.

This FEIS provides detailed descriptions of each alternative and discloses the potential environmental consequences related to implementation. The four alternatives are

- Alternative A is the no action alternative and represents the 1987 plan, as amended. This alternative would continue to guide management of the Apache-Sitgreaves NFs. Alternative A emphasizes timber management as a primary tool for providing forest products for local and regional industrial and individual needs while meeting wildlife habitat needs.
- Alternative B is the proposed action (proposed plan) and the preferred alternative. This alternative was designed to address the need for change by addressing the demands for wildlife habitat, community protection, commodity outputs, and recreation opportunities with an emphasis on ecological restoration.
- Alternative C responds to public comments that forest management should provide increased benefits to local communities through management emphasis on commodity outputs and motorized and developed recreation. There is an emphasis on contributing to local and regional economic sustainability through ecological restoration
- Alternative D responds to public comments that forest management should emphasize more natural processes and nonmotorized and dispersed recreation opportunities. There is an emphasis on ecological restoration across all vegetation types.

The Notice of Availability announcing the release of the proposed plan and draft environmental impact statement was published in the Federal Register on February 15, 2013, which initiated a 90-day public comment period. In late February 2013, additional public meetings were held in

Show Low, Springerville, and Duncan (Clifton). Over 41,000 comment letters were received from individuals, organizations, agencies, and one tribe. These comments led to minor changes throughout the plan and environmental impact statement, all of which were within the scope of the analysis in the draft environmental impact statement.

The regional forester for the Southwestern Region will make the final decision on the selected alternative for the new land management plan.

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Commonly Used Acronyms

ADA – Arizona Department of Agriculture

ADEQ – Arizona Department of Environmental Quality

ADOT – Arizona Department of Transportation

AMS – Analysis of the Management Situation

AZGFD – Arizona Game and Fish Department

ASQ – Allowable Sale Quantity

BAER – Burned Area Emergency Response

BLM – Bureau of Land Management

BMP – Best Management Practice

CCF – 100 cubic feet

CER – Comprehensive Evaluation Report

CFR – Code of Federal Regulations

CWPP – Community Wildfire Protection Plan

CWRF – Cottonwood-Willow Riparian Forest

DBH – Diameter at Breast Height

DMCF – Dry Mixed Conifer Forest

DRC – Diameter at Root Collar

EI – Ecological Indicator

EIS – Environmental Impact Statement

EPA – Environmental Protection Agency

EO – Executive Order

ESA – Endangered Species Act

FR – Federal Register

FSH – Forest Service Handbook

FSM – Forest Service Manual

GBG – Great Basin Grassland

GIS – Geographical Information System

GTR – General Technical Report

HUC – Hydrologic Unit Code

IC – Interior Chaparral

IRA – Inventoried Roadless Area

MBDRF – Mixed Broadleaf Deciduous Riparian Forest

MIS – Management Indicator Species

MOU – Memorandum of Understanding

MPOW – Madrean Pine-Oak Woodland

MSO – Mexican Spotted Owl

MSG – Montane/Subalpine Grasslands

MVUM – Motor Vehicle Use Map

MWRF – Montane Willow Riparian Forest

NEPA – National Environmental Policy Act

NF – National Forest

NFMA – National Forest Management Act

NFS – National Forest System

NOA – Notice of Availability

NOI – Notice of Intent

NPS – National Park Service

NRCS – Natural Resource Conservation Service

NRHP – National Register of Historic Places

NRT – National Recreation Trail

NVUM – National Visitor Use Monitoring

OHV – Off-highway Vehicle

PAC – Protected Activity Center

PFA – Post-fledging Family Area

PFC – Proper Functioning Condition

PJW – Piñon-Juniper Woodland

PNVT – Potential Natural Vegetation Type

PPF – Ponderosa Pine Forest

RMRS – Rocky Mountain Research Station

RNA – Research Natural Area

ROS – Recreation Opportunity Spectrum

SAD – Sudden Aspen Decline

SDG – Semi-Desert Grassland

SFF – Spruce-Fir Forest

TCP – Traditional Cultural Property

TES – Terrestrial Ecosystem Survey

USC – United States Code

USDA – United States Department of Agriculture

USFS – United States Forest Service

USFWS – United States Fish and Wildlife Service

WCRA – Wetland Cienega Riparian Areas

WMCF – Wet Mixed Conifer Forest

WQA – Wildlife Quiet Area

WUI – Wildland-urban Interface

Chapter 1. Purpose and Need for Change

Document Structure

The Forest Service has prepared this programmatic final environmental impact statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This FEIS discloses the environmental consequences that would result from the proposed action and alternatives. The document is organized into four chapters plus an appendix (consisting of multiple parts) and index:

- **Chapter 1. Purpose and Need for Change:** This chapter includes information on the purpose and need for changing the 1987 Apache-Sitgreaves National Forests Plan (1987 plan) and the Agency's proposal for achieving that purpose and need. This section also details the scope of analysis, how the Forest Service informed the public of the proposed action (proposed plan), and how the public responded.
- **Chapter 2. Alternatives, Including the Proposed Action:** This chapter provides a more detailed description of the Agency's proposed plan as well as alternative methods for achieving the stated purpose. The alternatives were developed based on issues raised by the public. Finally, this section includes a summary table of the environmental consequences associated with each alternative.
- **Chapter 3. Affected Environment and Environmental Consequences:** This chapter describes the affected environment (current condition) for each resource. It also describes the environmental consequences (effects) of implementing each alternative. This analysis is organized by resource area.
- **Chapter 4. Consultation and Coordination:** This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.
- **Appendix:** The appendix consists of multiple parts and provides more detailed information to support the analyses presented in the environmental impact statement such as the public comments and responses and a description of analysis process.
- **Index:** The index provides page numbers by topic.

Additional documentation, including more detailed analyses of resources, may be found in the project record (the "Plan Set of Documents") located in the supervisor's office.

Introduction

The 2.1 million acre[1] Apache-Sitgreaves National Forests (Apache-Sitgreaves NFs or the forests) are managed as a single administrative unit and are located in east-central Arizona. The Apache-Sitgreaves NFs are managed by the Forest Service, an agency of the U.S. Department of Agriculture (USDA). The forests are currently being managed under the 1987 plan. The Apache-Sitgreaves NFs are proposing to revise the 1987 plan. The Apache-Sitgreaves NFs are situated in Apache, Coconino, Greenlee, and Navajo Counties. Ranger district offices are located in Alpine, Clifton, Pinetop-Lakeside, Overgaard, and Springerville. The supervisor's office is located in Springerville (figure 1).

[1] In addition, approximately 650,000 acres of the Apache National Forest are located in New Mexico. The Gila National Forest administers and manages these lands according to the Gila National Forest land management plan. They are not included in this analysis.

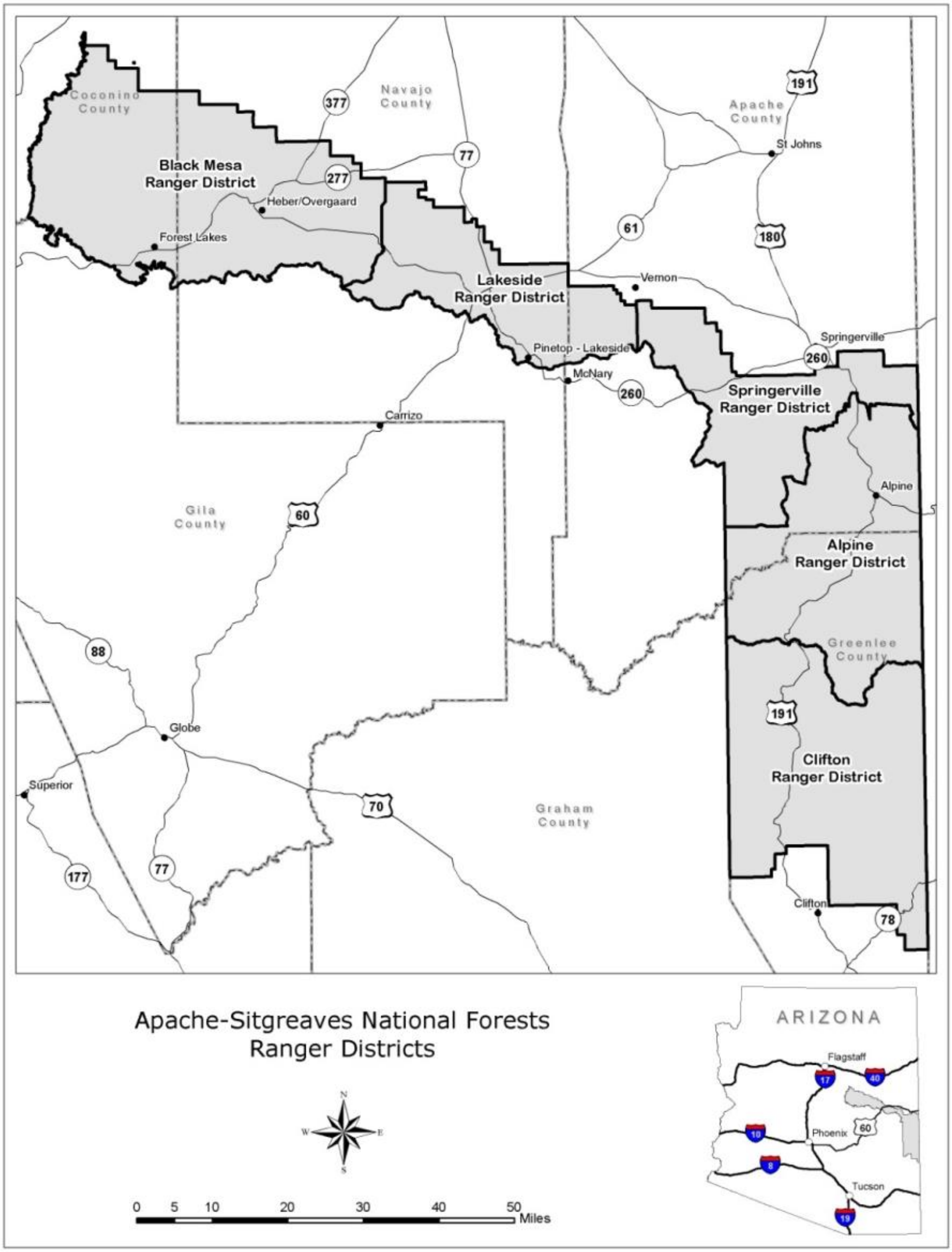

Figure 1. Map of ranger districts on the Apache-Sitgreaves NFs

Purpose and Need for Change

The purpose of this FEIS is to evaluate different programmatic strategies (or alternatives) for revising the existing land management plan (1987 plan) and disclose the potential environmental consequences of these alternatives. The purpose of a land management plan is to provide guidance for managing the forests' resources in a manner that maintains or moves toward desired conditions.

The 1987 plan was approved in August 1987 and has been amended 15 times. The intent of the 1987 plan was to guide forest management for 10 to 15 years. However, after 27 years, it no longer addresses changes that have occurred to economic, social, and ecological conditions; new policies and priorities; and new information based on monitoring and scientific research.

Using extensive public and employee collaboration and the "Analysis of the Management Situation"[2] the Apache-Sitgreaves NFs identified several needs for change in the 1987 plan. The needs for change are summarized below in three revision topics: (1) Maintenance and Improvement of Ecosystem Health, (2) Managed Recreation, and (3) Community-Forest Interaction.

There is a need to revise the 1987 plan to (1) guide natural resource management activities on the forests for the next 10 to 15 years, (2) address public issues and the need for change as summarized in the three revision topics, and (3) meet the legal direction of the National Forest Management Act (NFMA) of 1976 and the provisions of the 1982 Planning Rule[3] to revise the plan every 10 to 15 years.

Revision Topic 1: Maintenance and Improvement of Ecosystem Health

Conditions have changed since the 1987 plan was issued. Vegetation conditions (e.g., vegetative structure, composition, function) are divergent from reference conditions. Forest conditions indicate a substantial departure from the natural fire regime. There are plant and animal species that need further consideration in the plan revision process. There are also emerging issues not addressed by the 1987 plan (e.g., invasive plants and animals, climate change).

Vegetation Conditions

Thirteen of the 14 potential natural vegetation types (PNVTs) on the Apache-Sitgreaves NFs vary (sometimes substantially) in structure, composition, function, and natural disturbance processes

[2] The "Analysis of the Management Situation" includes the "Comprehensive Evaluation Report" (Forest Service, 2008a), "Ecological Sustainability Report" (Forest Service, 2008e), "Economic and Social Sustainability Assessment" (Forest Service, 2009a), "Resource Evaluations" (Forest Service, 2008b), "CER Supplement to Meet AMS Requirements " (Forest Service, 2010a), and the "Wallow Fire Changed Condition Assessment" (Forest Service, 2012e). These documents analyzed and evaluated the need to change the 1987 plan and informed the development of the three revision topics.

[3] The transition provision, 36 CFR § 219.17(b)(3), of the 2012 Planning Rule (77 FR 21162-21276) allows use of the provisions of the planning rule, commonly called the 1982 Planning Rule, to amend or revise plans.

from desired conditions[4]. These include ponderosa pine, dry mixed conifer, spruce-fir, and wet mixed conifer forests; piñon-juniper and Madrean pine-oak woodlands; Great Basin, semi-desert, and montane/subalpine grasslands; mixed broadleaf deciduous, montane willow, and cottonwood-willow riparian forests; and wetland/cienega riparian areas. Interior chaparral is the only PNVT that is at or close to desired conditions.

Ponderosa pine and dry mixed conifer forested PNVTs are generally composed of dense groups of too many young, small trees prone to stand-replacing crown fires and insect and disease infestations. The desired condition is to have more open forests containing a variety of ages and sizes of trees. Surface fire would play an active role in maintaining desired conditions.

Spruce-fir and wet mixed conifer forested PNVTs generally have too many young and small trees, and have been impacted by insects and disease resulting in standing dead trees. These dead trees contribute to higher intensity wildfire. The desired condition is to have a closed canopy forest with more mature and large trees where stand-replacing fires occur infrequently.

The presence of aspen in several PNVTs is declining because of insects, disease, overbrowsing by wildlife and livestock, absence of natural fire, and unnaturally dense stands of conifers that shade out and inhibit aspen growth. The desired condition is to have a sustainable amount of aspen on the forests because aspen stands have scenic values and provide wildlife habitat.

The Madrean pine-oak woodland PNVT has too many young and mid-aged trees grouped closer together than the desired condition of medium to large trees with open canopy. The piñon-juniper woodland PNVT is fairly close to the desired condition, although some areas have too many big trees spaced close together and lack some grass and forb species. Within these woodlands, there are also areas with little ground cover contributing to unsatisfactory soil conditions and increased erosion and sedimentation.

Riparian areas are a focal point for use by humans, wildlife, and livestock. Over time, these stressors have caused changes in the riparian vegetation. The desired condition is to have more mature trees and saplings and the variety of species appropriate in these areas. Riparian areas are important because water is limited in the region. Although riparian areas cover less than 3 percent of the Apache-Sitgreaves NFs, the forests contribute the major portion of these riparian PNVTs within the greater ecoregion (which extends beyond the forests' boundaries).

The three grassland PNVTs have experienced dramatic changes over time, including encroachment by trees and shrubs, loss of perennial grass cover, and spread of nonnative species. Many areas of the forests that appear to be piñon-juniper woodlands are actually encroached grasslands. The desired condition is to have grasslands with less than 10 percent of the area in woody species canopy and with the appropriate species composition. Healthy grasslands are important habitat for a variety of wildlife species and are essential for maintaining pronghorn antelope populations. Healthy grasslands also contribute to the availability of rangelands for livestock grazing.

All 14 PNVTs are key components in sustaining terrestrial and aquatic ecosystems and providing goods and services (e.g., water resources, recreation settings, wood products, rangelands,

[4] In some vegetation types, desired conditions are the same as reference conditions; see the "Vegetation" section in chapter 3 for more information.

medicinal plants). Unhealthy vegetation conditions threaten the viability of plants and animals and the forests' ability to provide a sustained flow of goods and services. They also contribute to the occurrence of uncharacteristic wildfire which may, in turn, threaten towns and communities adjacent to the Apache-Sitgreaves NFs.

There is a need to describe the desired composition, structure, cover, and fire regime of the 14 PNVTs that would result in resilient, functioning ecosystems. In addition, there is a need to guide future vegetation management activities, including wildland fire and mechanical treatments, to maintain or move toward desired conditions.

Wildlife and Fish Habitat

The provisions of the 1982 Planning Rule require habitat be managed to maintain viable populations of existing native and desired nonnative vertebrate and plant species in the planning area. The Endangered Species Act requires Federal agencies to conserve and recover endangered and threatened species and their habitats. There are currently 18 animal and fish species listed or proposed for listing as threatened and endangered. Thirteen of these species have designated or proposed critical habitat located on the Apache-Sitgreaves NFs. There is a need to incorporate management direction to guide future projects to maintain species diversity and viability across the planning area. In addition, there is a need to reevaluate and update the management indicator species (MIS).

Soil and Water

All watersheds have some areas with unsatisfactory soil condition and streams with reduced water quality. The soil condition rating is unsatisfactory or impaired on more than 30 percent of the forests, compared to the reference conditions of less than 5 percent. Water diversions and impoundments, unnaturally dense forests, grazing, and prolonged drought have altered streamflow, water availability, and riparian conditions. There is a continuing need to improve soil and riparian conditions, prevent water quality deterioration, and acquire or maintain instream flow. Soil and water protection is mandated by law (e.g., National Forest Management Act, Clean Water Act) and Forest Service policy.

Invasive Species

Invasive species are a growing threat to native species, ecosystem function, and the quantity of forest goods and services. Invasive plants (e.g., mullein, tamarisk, yellow starthistle) currently infest at least 30,000 acres across the Apache-Sitgreaves NFs. Invasive animals (e.g., crayfish, bullfrogs) prey on and outcompete native species and degrade habitats many native species depend on. There is a need to provide direction to control, treat, and eradicate invasive plant and animal species.

Revision Topic 2 - Managed Recreation

There are several concerns related to recreation not adequately addressed in the 1987 plan. These include more people recreating on the forests and the changing demographics of forest users. There are special areas (e.g., scenic byways) not mentioned in the 1987 plan, including the 25 rivers that are eligible or suitable for the National Wild and Scenic Rivers System. There may be

NFS lands that could be recommended to Congress for designation into the National Wilderness Preservation System.

Recreation Opportunities

There is an increased demand for the number and type of recreation opportunities on the Apache-Sitgreaves NFs.

More people use the Apache-Sitgreaves NFs for outdoor recreation than for any other purpose. Activities include relaxing and escaping the heat, fishing, hiking, off-highway vehicle (OHV) use, viewing natural features and wildlife, camping, driving for pleasure, picnicking, large group gatherings, and hunting.

State highway improvements provide easier access to the forests from Arizona’s major metropolitan areas, increasing the number of visitors and demand for recreation. In addition, the demographics of the recreating public are changing. An aging and urban population and increased ethnic diversity contribute to a demand for varied recreation opportunities. Forest managers face major challenges in maintaining and developing quality recreation opportunities and a safe transportation system, while providing for resource protection.

There is a need to update the spectrum of recreation opportunities to reflect current and projected recreation needs, natural resource impacts, and public input. This includes identification of areas that are developed for high use and areas that resemble more natural landscapes. There is also a need to identify the suitability of areas for motorized vehicle use and other recreational activities.

Recommended Wilderness

As required by the provisions of the 1982 Planning Rule, all Apache-Sitgreaves NFs lands were evaluated for wilderness character. Thirty-eight areas (totaling approximately 700,000 acres) were identified as potential wilderness which could be recommended to Congress for designation.

There is a need to recommend areas, if determined appropriate by the responsible official, to Congress for wilderness designation and to provide interim management guidance.

Eligible and Suitable Wild and Scenic Rivers

There are 25 rivers with a combined 378 river miles eligible or suitable for inclusion into the National Wild and Scenic Rivers System. The 1987 plan provides direction for only three of these rivers. Although current Agency policy (Forest Service Handbook 1909.12 Interim Management of Eligible or Suitable Rivers) provides guidance to protect the outstandingly remarkable values of these rivers, there is a need to provide direction for all 25 eligible or suitable wild and scenic rivers.

Recommended Research Natural Areas

Research natural areas (RNAs) are maintained in natural conditions insofar as possible to provide for research, observation, and study. There is a need across the Southwestern Region to designate RNAs which represent specific vegetative types (e.g., semi-desert grassland, montane willow and cottonwood-willow riparian forests, wetland/cienega riparian areas, aspen) and aquatic habitats. The Apache-Sitgreaves NFs have the opportunity to contribute to these needs by recommending five eligible areas for RNA designation: Thomas Creek, Corduroy, Three Forks, Lower Campbell Blue, and Sandrock.

Other Special Areas

There are other existing special areas not recognized in the 1987 plan such as the Heber Wild Horse Territory, scenic byways, and national recreation trails. There is a need to provide management direction for these special areas.

Revision Topic 3 – Community-Forest Interaction

The Apache-Sitgreaves NFs are literally the backyard for many residents in the White Mountains region of Arizona. Many communities adjoin the forests, while others are completely surrounded. Because of this close proximity, many communities and private landowners may be affected by forest management decisions. These entities, in turn, may affect forest management.

There are several social concerns that have prompted a need to change the 1987 plan. Communities are at risk from uncharacteristic wildfire. There are increasing demands for goods, services, and forest access from growing populations and urban development that borders the forests. Many communities are surrounded by the forests and can be affected by adjustment to the forests' land ownership. Commodity use and forest product outputs have shown declines from the past. However, these forest outputs and associated uses contribute to sustaining the lifestyles and traditions of local communities. Energy resource demands also continue to grow.

Contribution to Local Communities

Although local communities have shifted from commodity-based economies to service-based economies, there are still local benefits associated with wood harvesting, grazing, and gathering of forest products.

There is a need to continue to provide a sustainable supply of forest and rangeland resources that is consistent with achieving desired conditions and supporting local communities. There is also a requirement (per the provisions of the 1982 Planning Rule) to determine the suitability of lands for timber production and the allowable sale quantity of timber.

Threat to Communities from Wildfire

Many nearby communities and portions of the Apache-Sitgreaves NFs are at increased risk from wildfires because vegetation conditions are divergent from desired conditions, including fuel loads at uncharacteristically high levels. The events surrounding the 2002 Rodeo-Chediski Fire and the 2011 Wallow Fire, the two largest fires in Arizona history, served as a catalyst for increased public concern. Following the Rodeo-Chediski Fire, communities developed community wildfire protection plans (CWPPs), which identify and prioritize treatment areas to reduce the wildfire hazard to communities. The 1987 plan does not recognize this increased threat from wildfire nor does it prioritize treatments to address the threat. There is a need to provide direction to address communities at risk from uncharacteristic wildfire, including describing the appropriate vegetation desired conditions and fire regime and treatment of the wildland-urban interface.

Urban Interface Demands

Many communities are completely surrounded by the Apache-Sitgreaves NFs and are limited in the ability to expand. In the past decade, there has been a major increase in development on land adjoining and/or surrounded by the forests. Demands related to this growth include access to the forests, utility corridors, roads, special use permits, and recreation opportunities. There is a need to provide updated guidance for addressing urban interface demands and land ownership adjustments.

New Energy Development

There are three existing high power energy corridors located on the Apache-Sitgreaves NFs. Two corridors traverse the west side of the forests, one containing a 500 kV transmission line and one containing 345 kV transmission lines. One 345 kV transmission line runs through a portion of the Clifton Ranger District in the southeastern portion of the forests. There may be a need for additional energy corridors or developments (e.g., electric transmission lines, pipelines, wind turbines) because of the expected increased demand for electricity to serve the growing populations of Arizona and the Southwest. There is a need to provide guidance for the existing energy corridors and criteria for establishing new energy corridors or developments which was not provided in the 1987 plan.

Proposed Land Management Plan

The Forest Service proposes to revise the 1987 plan for the Apache-Sitgreaves NFs. The proposal updates the desired conditions, objectives, standards, guidelines, special areas, suitability, and monitoring requirements that will guide management of the Apache-Sitgreaves NFs for the next 10 to 15 years. It also changes the description and allocation of the management areas to achieve forestwide desired conditions and to provide opportunities for a range of activities. The proposal addresses the need to change the 1987 plan related to the three revision topics listed above.

In response to the need for change, the regional forester of the Southwestern Region (the responsible official for this decision) and the Apache-Sitgreaves NFs have developed the “Apache-Sitgreaves National Forests Land Management Plan” (plan). The plan accompanies this document.

Decision Framework

The regional forester for the Southwestern Region will make the final decision on the selected alternative for the revised land management plan. The regional forester will review the proposed plan, the other alternatives, and the environmental consequences, then decide which plan alternative best achieves the desired conditions, multiple-use concept, diverse needs of people, and sustainable management of the Apache-Sitgreaves NFs as well as conforming to the direction of the National Forest Management Act (NFMA) and the Multiple Use–Sustained Yield Act (MUSYA).

Scope of the Analysis

The programmatic analysis in this FEIS is limited to the potential environmental consequences associated with the need for change and on issues derived through public comment received throughout development of the proposed plan and its alternatives. Many topics are beyond the scope of the plan revision process and will not be considered in the FEIS. Projects implementing the land management plan will be analyzed in subsequent site-specific environmental documents. Project-level impacts are not disclosed in this document. For example, the designation of specific routes, trails, and areas for motorized vehicle travel will not be considered during the plan revision process but would be addressed in separate environmental analyses. Some topics (e.g., hunting regulations), although important, are beyond the authority or control of the Apache-Sitgreaves NFs and will not be considered. In addition, some topics, such as wild and scenic river suitability determinations, will not be undertaken at this time but would be addressed in the future in separate analyses.

Because the proposed plan and other alternatives involve potential environmental consequences that could occur over a broad geographic region and time horizon, the depth and detail of the impact analysis is fairly general, focusing on major impacts in a qualitative manner.

Land Management Plan Decisions

The Forest Service makes two types of management decisions for National Forest System (NFS) lands: programmatic (or broad) and project-level.

Programmatic decisions are made in the land management plan, and they are expressed as goals (identified as desired conditions), objectives, standards, guidelines, special areas, suitability, and monitoring. The land management plan provides a broad framework that guides project-level decisions but does not authorize, fund, or carry out any site-specific activities. Instead, the land management plan establishes limitations on what actions may be authorized and what conditions must be met during project-level decisionmaking.

Project-level decisions are made for site-specific activities such as constructing a new trail or conducting a prescribed burn. Project-level decisions must comply with NEPA procedures and be consistent with the land management plan.

Data collection, analysis, and public involvement are important to making management decisions; these steps guide development of the land management plan and the design of projects that implement the plan and culminate in the approval of project-level decisions. Monitoring and evaluation are also important to help inform future management decisions.

The primary decisions made in the land management plan include the following:

- Establishment of desired conditions and objectives that reflect the multiple-use concept central to the mission of the Forest Service;
- Establishment of standards and guidelines to apply to future activities;
- Identification of areas suitable or not suitable for various uses;
- Wilderness recommendations and other recommendations for special area designation; and
- Establishment of a monitoring and evaluation strategy.

Tribal Consultation

The Apache-Sitgreaves NFs have consulted with nine tribes and one chapter that use the forests for traditional, cultural, or spiritual activities. The following tribes and chapter were consulted: White Mountain Apache Tribe, San Carlos Apache Tribe, Hopi Nation, Navajo Nation, Pueblo of Zuni, Yavapai-Apache Tribe, Tonto Apache Tribe, Fort McDowell Yavapai Nation, Yavapai-Prescott Indian Tribe, and the Ramah Chapter of the Navajo Nation.

Tribes were initially informed about plan revision in October 2006, through a letter explaining the revision process and extending an open invitation to meet with the Apache-Sitgreaves NFs. A consultation letter was sent to the tribes in June 2009 asking for input on the working draft land management plan. In December 2009, the tribes were sent a letter that provided the revision status and upcoming publication of the notice of intent (NOI) and invited their comments and concerns. In May 2012, tribes were sent working drafts of the proposed land management plan and draft environmental impact statement (DEIS) for their review prior to releasing the documents to the public. In early February 2013, tribes were invited to review the published proposed plan and the DEIS. In addition to consultation, the tribes have been included in all public outreach efforts throughout the plan revision process.

Four tribes provided written responses: White Mountain Apache Tribe, Navajo Nation, Tonto Apache Tribe, and Yavapai-Prescott Indian Tribe. Consultation meetings were held with the San Carlos Apache Tribe (August and November 2006), White Mountain Apache Tribe (August 2006, March 2007, and April 2010), Navajo Nation (August 2006, September 2008, and December 2009), Hopi Tribe (August 2006 and November 2009), and Pueblo of Zuni (August 2006, September 2008, and July 2011).

Concerns identified by the tribes are discussed in the “American Indian Rights and Interests” section in chapter 3. Concerns include tribal access to the forests and protection of sacred and archaeological sites as traditional cultural properties (TCPs), water sources, and plants for subsistence and medicine. These concerns are addressed in the proposed plan.

Public Involvement

Extensive public involvement and collaboration on the revision of the 1987 plan preceded publication of this FEIS. The plan revision effort has been on the forests’ “Schedule of Proposed Actions” (SOPA) quarterly since 2008. Informal discussions with the public regarding needed changes to the 1987 plan began with a series of public meetings during the summer of 2006. From 2006 to 2014, multiple meetings, correspondence, news releases, comment periods, and other tools were utilized to gather feedback from the public, forest employees, Federal and State agencies, and local governments. Detailed information about the Apache-Sitgreaves NFs public involvement process can be found in appendix F and the public participation plan (Forest Service, 2014d) in the “Plan Set of Documents.”

The notice of intent (NOI) to revise the 1987 plan and prepare an environmental impact statement was published in the Federal Register (74 FR 68776-68779) on December 12, 2009. The NOI requested input on the need for change and proposed action, specifically if any substantive issues or concerns were missing. In March and April 2010, four public meetings and an informal comment period were held to gather feedback on the initial set of draft alternatives.

Prior to the release of the DEIS in February 2013, the forests had received over 4,000 comments since initial scoping in 2006. Some comments were eliminated from detailed study because they were (1) outside the scope of the proposed action, (2) already decided by law, regulation, or a higher level decision, (3) irrelevant to the decision to be made, or (4) conjectural and not supported by scientific or factual evidence. Other comments fell into the following categories: forest health and restoration, treatment methods, wildlife needs, recreation opportunities, wilderness resources, wild and scenic rivers, threats to communities from wildfire, contributions to local communities including availability of forest products and rangelands, land exchanges, and new energy corridors.

Comments received early in the public involvement process were used along with science-based evaluations (e.g., “Analysis of the Management Situation”) to draft the initial proposed plan. Comments received later in the process were used to modify the proposed plan, where appropriate. In situations where a modification of the proposed plan could not adequately address a comment, consideration was given as to whether the comment represented an unresolved conflict or issue that would require development of an alternative to the proposed plan.

The Notice of Availability announcing the release of the proposed plan and DEIS was published in the Federal Register (78 FR 11171) on February 15, 2013, which initiated a 90-day public comment period. Over 41,000 comment letters were received from individuals, organizations, agencies, and one tribe. These comments are summarized and responded to in appendix A. The comments led to minor changes throughout the plan and environmental impact statement, all of which were within the scope of the analysis in the draft environmental impact statement (see “Summary of Changes” section below).

Summary of Changes from the Proposed Plan and Draft Environmental Impact Statement

Changes made in the plan and FEIS were driven by specific comments from the public, employees, other government agencies, and tribes on the proposed plan and draft environmental impact statement (DEIS). Changes made to the plan include the following:

- Added a wildland fire management section to better describe management intent;
- Changed the recreation suitability for recommended wilderness; removed the suitability of mechanized use within recommended wilderness in alternatives B and C to provide consistent management direction with the adjoining wilderness;
- Removed direction to establish forage reserves; the direction was deemed not necessary;
- Modified vegetation herbaceous cover and composition desired conditions, standards, and guidelines to better clarify the intent and updated grass height desired conditions based on plant taxonomic descriptions;
- Changed livestock grazing suitability; removed the Black River Conservation Area from the table because the area is covered by the category “Current National Forest System land not in a grazing allotment”;
- Added to “Background” and “Management Approaches” sections to recognize other direction or management emphasis (e.g., feral horses, cave management, drought policy);
- Moved “Other Sources of Information” sections to Appendix D. Relevant Laws, Regulations, Policies, and Other Sources of Information;

- Clarified language throughout the plan, added an acronym list, and expanded the glossary;
- Updated tables and figures based on updates to information between the draft and final documents; and
- Made other relatively minor changes, including factual corrections.

Changes made to the FEIS include the following:

- Considered eight additional alternatives not analyzed in detail; these are disclosed in the "Alternatives Considered but Eliminated from Detailed Study" section in chapter 2;
- Updated effects determinations for threatened and endangered species to reflect the final biological assessment (Forest Service, 2014cc);
- Added appendix A which includes responses to public comments on the proposed plan and DEIS;
- Added appendix H which contains comment letters from government and tribal entities;
- Clarified language throughout the FEIS, added an acronym list, and expanded the glossary;
- Updated tables and figures based on updates to information between the draft and final documents; and
- Made other relatively minor changes, including factual corrections.

Issues that Served as the Basis for Alternative Development

The following items represent issues that resulted from unresolved conflicts during the iterative development of the proposed plan. These issues led to development of alternatives C and D (see chapter 2 for more information on alternative development).

- **Strategy for Restoring Vegetation:** Overall, during scoping, public comments supported the need to move toward desired conditions that are more healthy and resilient to anticipated future changes. However, opinions differed on what a "healthy" forest is, and the means to achieve it. For example, some people disagreed with the proposed plan vegetation treatment strategy and wanted to retain all old and large trees for wildlife habitat, while others felt it is important to remove more of these trees to contribute to the local wood industry. Also, some wanted the Forest Service to use more logging and thinning than what is identified in the proposed plan, while others desired an approach relying on natural processes such as wildland fire.
- **Amount of Wildlife Quiet Areas:** Habitat security and connectivity is important for maintaining species viability. The proposed plan identifies a management area (Wildlife Quiet Area Management Area) to provide for specific species needs. Some comments indicated a need for more or less areas with reduced disturbances to wildlife.
- **Type and Amount of Recreation Opportunities:** Public opinions are divided on the appropriate mix of different types of recreation settings and opportunities that should be provided. The proposed plan attempts to provide a balance of recreation opportunities. Some people wanted additional developed recreation facilities, while others wanted no new development and felt the Apache-Sitgreaves NFs should only maintain and improve existing recreation facilities. There were also conflicts over the amount of land that should be managed for motorized versus nonmotorized activities.

- **Amount of Wilderness:** There was a wide variety of opinions as to whether the Apache-Sitgreaves NFs need more wilderness. The proposed plan recommends additions to two existing wilderness areas. There were some people who desired no additional wilderness, while others wanted more. In addition, some people wanted the Blue Range Primitive Area designated as wilderness, and others wanted to remove the primitive area designation.
- **Availability of Wood Products:** There are varying opinions about how much commodity-type activities should occur on the Apache-Sitgreaves NFs. The proposed plan would make a variety of wood products (e.g., logs, biomass, firewood) available for personal and industrial use. Some people wanted the forests to make more wood products available, and other people wanted a substantial decrease in the amount of trees removed from the forests.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes each alternative considered for the revision of the 1987 plan. It also presents the alternatives in comparative form, describing the differences between each and providing a basis for choice among options for the responsible official. Some of the information used to compare alternatives is based on the land management plan decisions (e.g., objectives, suitability) and some of the information is based on expected outcomes of implementing each alternative (e.g., amount of forest products available).

Alternative Development

The proposed plan (alternative B) was developed iteratively in a collaborative manner to address the need for change. In August 2008, the forests released an initial set of draft desired conditions for public and forest employee review and feedback. After incorporating comments and refining the desired conditions, the forests released a working draft land management plan for review and comment in June 2009. These collaborative efforts between the Forest Service and external groups and individuals led to development of the proposed plan (alternative B). Two additional alternatives (alternatives C and D) were generated based on issues not addressed by the proposed plan. These issues are listed in chapter 1 under the section “Issues that Served as the Basis for Alternative Development.”

Alternative C was developed to respond to issues by placing more emphasis on treating vegetation mechanically to contribute to local and regional economic sustainability and maintain or move toward desired conditions. There is no emphasis to retain old growth to the greatest extent possible so there are more opportunities to meet forest products desired conditions. There is less land allocated to the Wildlife Quiet Area Management Area. This alternative places an emphasis on developed and motorized recreation opportunities and recommends less acreage for wilderness designation. This alternative identifies more land suitable for timber production and would offer more wood products.

Alternative D was developed to respond to issues by placing more emphasis on natural processes (use of wildland fire) as a restoration tool to maintain or move toward desired conditions. This alternative emphasizes the retention of all large and old trees. There is more land allocated to the Wildlife Quiet Area Management Area. This alternative places an emphasis on dispersed and nonmotorized recreation opportunities and recommends more acreage for wilderness designation. This alternative does not identify any lands as suitable for timber production and would offer fewer wood products.

Drafts of the proposed plan and alternatives were shared with the public and Forest Service employees during the spring of 2010. Four public meetings, an informal comment period, and meetings with forest employees were held to gather feedback as to whether these alternatives addressed concerns and whether the range of alternatives was adequate.

The interdisciplinary team, taking into account this feedback, met with the forest supervisor and received direction to refine the initial draft alternatives. This is reflected in the action alternatives (alternatives B, C, and D) below.

All action alternatives considered (1) comments from the public, other agencies, forest employees, and tribal governments and (2) scientific information from the "Analysis of the Management Situation." Each alternative had to meet the following criteria set by the forest supervisor and the forests' leadership team:

- Alternatives must follow existing laws, regulations, and policies.
- The forests will be managed for multiple uses as suitable.
- The alternatives must be realistic, implementable, and able to be monitored within anticipated future budgets.

The Notice of Availability announcing the release of the proposed plan and DEIS was published in the Federal Register (78 FR 11171) on February 15, 2013, which initiated a 90-day public comment period. Over 41,000 comment letters were received from individuals, organizations, agencies, and one tribe. These comments are summarized and responded to in appendix A. The comments did not uncover additional unresolved issues; therefore no new alternatives were analyzed in detail. The comments led to minor changes throughout the plan and environmental impact statement, all of which were within the scope of the analysis in the draft environmental impact statement (see "Summary of Changes" in chapter 1).

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives not developed in detail (40 CFR § 1502.14). Public comments received in response to the need to revise the land management plan provided suggestions for alternative methods to achieve the desired conditions. Some of these may have been outside the scope of revision, duplicative of the alternatives considered in detail, or determined to cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but they were dismissed from detailed consideration for reasons described below.

June 2009 Working Draft Land Management Plan

The forests released a working draft land management plan for review and comment in June 2009. This alternative, based on public and agency input, evolved into what is now the proposed plan.

Initial Draft Alternatives

In March 2010, the forests released a set of three draft alternatives for public review and comment. These alternatives, based on public and agency input, evolved into the three action alternatives analyzed in this FEIS.

Alternatives with No Timber Harvest or Large Increase in Timber Harvest

These alternatives were considered to address public comments regarding whether timber harvesting should be allowed on the Apache-Sitgreaves NFs, and if so, at what level.

In the Multiple Use–Sustained Yield Act of 1960 (P.L. 86-517), Congress declared that national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes. The National Forest Management Act of 1974 (P.L. 94-588) reiterates this commitment to multiple use. Given this legal direction, it was determined that an alternative to eliminate timber harvesting is inconsistent with the mission of the Forest Service.

Timber harvesting is a necessary management tool to maintain and restore vegetation communities to desired conditions, produce commercial wood products, create and maintain varied wildlife habitat conditions, and treat areas identified in community wildfire protection plans. An alternative that eliminates timber harvest would not contribute to these purposes and, therefore, is outside the scope of this decision.

An alternative that called for large increases in timber harvest was also considered but not analyzed in detail, because maximizing timber production would not meet the desired condition to manage and protect other resources. The action alternatives provide a range of timber harvest amounts at levels that account for other uses and resource needs. Large increases in cutting levels could have the potential to threaten the viability of some wildlife and/or fish species.

Alternatives with No Livestock Grazing

This alternative was considered in response to public comments preferring no grazing on the Apache-Sitgreaves NFs.

A no grazing alternative would not meet the legal direction of the National Forest Management Act or Multiple Use–Sustained Yield Act which direct that forests will be managed using multiple use, sustained yield principles. Also, it would not allow the attainment of the desired condition for livestock grazing to contribute to the social, economic, and cultural diversity and stability of rural communities. Therefore, a no grazing alternative is inconsistent with the mission of the Forest Service, the land management plan's desired conditions, and outside the scope of this decision.

Stocking decisions (amount of livestock grazing authorized) for specific grazing allotments are beyond the scope of this analysis. Grazing is authorized through term grazing permits (a long-term authorization subject to forestwide standards and guidelines), allotment management plans, and annual operating instructions. Changes to these authorizations would be made through project-level analyses.

See the "Livestock Grazing" section in chapter 3 for a discussion of rangeland suitability.

Minimum Management Alternative

This alternative was considered in response to public comments that there should be no or minimal human intervention in the management of the Apache-Sitgreaves NFs.

This alternative would not meet the legal direction of the National Forest Management Act or Multiple Use–Sustained Yield Act which direct that forests will be managed using multiple use, sustained yield principles. Active management is also needed to maintain or move toward desired conditions, including to restore forest ecosystems, maintain recreation opportunities, reduce the threat of uncharacteristic wildfires to communities, and maintain the availability of forest products.

Wilderness Alternatives

Requests for new wilderness areas were submitted by several groups.

These areas were considered in light of the evaluation of potential wilderness that was completed by the Apache-Sitgreaves NFs for the plan revision process. Portions of these external proposals are further considered in alternatives B, C, and D. Other portions were dismissed from detailed consideration because they did not meet the criteria for potential wilderness.

Wildlife Conservation Area Alternative

Based on input from several groups, an alternative was considered to manage portions of the Black Mesa and Lakeside Ranger Districts as wildlife conservation areas. The wildlife conservation area proposal included various components such as existing and new wildlife habitat areas, wildlife corridors, core black bear and mountain lion habitat, Mexican spotted owl protected activity centers, northern goshawk post-fledging family areas, and rivers eligible for designation under the Wild and Scenic Rivers Act.

Although this alternative was considered, it was not further analyzed because many of its components are included in the three action alternatives. Protected activity centers and post-fledging family areas are managed in all alternatives to conserve these species. The action alternatives include additional wildlife habitat areas (i.e., Wildlife Quiet Area Management Area) to help address habitat connectivity across the Mogollon Rim. Other areas (e.g., Natural Landscape Management Area, Recommended Wilderness Management Area) identified in the action alternatives also limit impacts to wildlife and wildlife habitat.

Alternatives to Designate or Remove Wild and Scenic Rivers

These alternatives were considered in response to public comments that specific river segments should be designated or removed from the National Wild and Scenic Rivers System. Designation or removal of a wild and scenic river is a congressional action.

The Apache-Sitgreaves NFs do not have any rivers designated in the National Wild and Scenic Rivers System; therefore, there are no rivers that can be removed. However, there are 25 rivers eligible or suitable for designation that must be managed to maintain or enhance their outstandingly remarkable values. Before a river can be recommended to Congress for designation into the system, a suitability study must be conducted. A suitability study for any additional river segments is beyond the scope of this plan revision process; it may be undertaken at some time in the future under separate analysis, as was done for KP Creek and the Blue River.

Changes to the Road and Motorized Trail System and Elimination of OHV Use

These alternatives were considered in response to public comments to change the road and motorized trail system and to eliminate the use of off-highway vehicles (OHVs).

Some public comments requested that, during the plan revision process, individual roads or trails or all unauthorized roads/trails be evaluated and either added to or removed from the transportation system. The land management plan provides a framework to guide future changes to the transportation system. Potential changes to the forests' transportation system would be evaluated in separate project-level analysis including the implementation of the Travel Management Rule (36 CFR § 212). As a result, this alternative was dropped from detailed consideration.

Other public comments expressed a need to eliminate the use of OHVs across the forests. OHV use has historically been permitted on the forests; it is a contemporary use of the forests and provides access to various portions of the forests. Local counties, the State of Arizona, and nearby national forests also allow OHV use. Future analyses (e.g., implementation of the Travel Management Rule) would consider additional locations for OHV use and evaluate related resource impacts. As a result, this alternative was dropped from detailed consideration.

Expanding Existing Energy Corridors

Arizona Public Service, an Arizona electric utility company, recommended that the Forest Service establish designated corridors for all existing transmission facilities. In addition, they requested expansion of all existing corridors with high voltage and extra high voltage transmission facilities to a width of 3 to 5 miles.

Each of the action alternatives establishes an Energy Corridor Management Area that provides guidance for existing facilities. The management area boundary follows the existing rights-of-way. In order to increase the width of the corridor, further analysis and a project-level decision would be needed. It was determined that this is beyond the scope of this revision process and would not be considered in further detail.

Alternatives with No Road or Motorized Trail Construction and Road Density Requirements

Comments received on the proposed plan and DEIS recommend an alternative with no road or motorized trail construction and other comments requested the Forest Service set limits for road density.

An alternative to forbid new road or motorized trail construction was considered to not be feasible. For example, new road construction may be required when access to a particular resource or private inholding is needed. New motorized trails may be needed to provide motorized recreation opportunities, including destinations and loops. The action alternatives, including the plan, address the impacts of roads and motorized trails on forest resources. Any new road or motorized trail construction would only be authorized following project-level NEPA analysis and would be accomplished using best management practices (BMPs) to minimize resource impacts while providing for forest access needs.

An alternative to include a road density standard was considered; the standard would limit the road system to a minimum number of miles of road per square mile of land. This alternative was considered but not analyzed in detail because future project-level planning efforts, including the implementation of the Travel Management Rule, would determine the designated road system. Site-specific travel management planning will use the framework set by the plan (e.g., desired conditions, standards, guidelines) and consider potential resource impacts, access needs, public input, and alternative views instead of an arbitrary road density target. The action alternatives, including the plan, provide for the protection and management of healthy and sustainable soils, watersheds, and wildlife connectivity, which are the primary resource concerns associated with National Forest System roads and motorized trails.

Alternatives with No Mining and Drilling

Comments received on the proposed plan and DEIS supported recommending an alternative that would prohibit mining and drilling. This was considered, however Congress declared in the Mining and Minerals Policy Act of 1970 that it is the continuing policy of the Federal Government, in the national interest, to foster and encourage the development of domestic mineral resources. In addition, the Forest Service does not have the discretionary authority to prevent mining of locatable minerals on public domain lands as prescribed by the 1872 Mining Law (as amended).

The action alternatives contain desired conditions, guidelines, and suitability determinations for minerals and geology related projects and activities, including surface occupancy stipulations. Any specific mining or drilling proposals would be evaluated to ensure consistency with the land management plan. Specific projects could be modified to include additional site-specific mitigation measures to protect forest resources.

Alternative with Maximum Treatments (Mechanical and Wildland Fire)

Comments received on the proposed plan and DEIS suggested an alternative that would maximize mechanical treatments (timber sales) and acres treated with wildland fire (planned and unplanned ignitions) with over 100,000 acres burned on an annual basis.

The action alternatives were developed to be realistic and implementable within anticipated future budgets (expected to be similar to current budgets). Alternative C represents the maximum mechanical treatments, while alternative D represents the maximum wildland fire treatments the forests anticipate being able to accomplish within the planning period. An alternative that would maximize both treatment types was not considered to be feasible based on anticipated future budgets.

Alternative with Different Livestock Grazing Management

Comments received on the proposed plan and DEIS recommended an alternative that provides a different strategy for managing livestock grazing than what was analyzed in the DEIS. It would provide management direction that would maximize long-term vegetative health through a conservative strategy toward grazing including restrictive standards to reduce unsatisfactory lands and improve forage and grassland habitat.

A change in the management of livestock grazing was not identified as need for change from the 1987 plan (see the “Purpose and Need for Change” section in chapter 1) and therefore, the topic of livestock grazing management did not drive alternative development.

All alternatives contain a primary desired condition for livestock grazing to “balance livestock grazing with available forage” on suitable grazing lands. Stocking decisions (amount of livestock grazing authorized) are authorized through term grazing permits (a long term authorization subject to forestwide standards and guidelines), allotment management plans, and annual operating instructions. Changes to these authorizations would be made through project-level analyses.

The plan provides direction for healthy and resilient vegetation, riparian areas, and water resources conditions in the short and long term. Therefore, the plan provides the framework for livestock stocking decisions that would provide for the health of vegetation and retention of water and forage for wildlife because those decisions must be consistent with applicable plan direction.

Alternative Based on the Old Growth Protection and Large Tree Retention Strategy

Comments received on the proposed plan and DEIS recommended an alternative based on the Old Growth Protection and Large Tree Retention Strategy (OGPLTRS) developed by public stakeholders for implementation in Four Forest Restoration Initiative (4FRI).

Although OGPLTRS does not dictate a universal upper cutting size limit (diameter cap); it does universally dictate keeping all pre-European-settlement (old) trees in all cases. The OGPLTRS proposes very specific tree retention requirements that are not appropriate for a programmatic land management plan. It reduces the flexibility that project level decisionmakers may need to design treatments that promote site specific desired conditions. Concepts from the OGPLTRs could be analyzed and incorporated at the project-level, if applicable.

The action alternatives provide guidance to retain appropriate amounts of large/old trees and/or old growth. In addition, alternative D analyzes a strategy similar to OGPLTRS because it contains a standard to retain all old and large trees.

Alternative to Manage Forests as a Refuge for Fish and Wildlife

Comments received on the proposed plan and DEIS recommended an alternative that focuses on managing for biological diversity and at-risk species to address scientific uncertainty and controversy regarding climate change impacts and creates a safe harbor and refuge for fish and wildlife, even at the expense of competing multiple use activities, such as livestock grazing, timber production, and motorized recreation.

The alternative was not considered in detail because, by focusing solely on fish and wildlife habitat over other uses, it would not meet the legal direction of the National Forest Management Act or Multiple Use-Sustained Yield Act, which direct that forests will be managed using multiple use, sustained yield principles. Also, in light of changes predicted by current climate models (e.g., increased wildfires, greater vulnerability to invasive species, changes in timing of precipitation), there is a need to reduce vulnerability by maintaining and restoring resilient native ecosystems which would be an outcome in alternatives B, D, C, and A (in order from greatest resilience to least). Management practices that sustain healthy plant and animal communities (e.g., thinning for age class diversity and structure, reclaiming and restoring native grasslands) promote resilience and reduce opportunities for disturbance and damage.

The primary focus area, or revision topic, for the action alternatives is “Maintenance and Improvement of Ecosystem Health.” The alternatives provide specific direction to provide for biodiversity and protect endangered species, other animals, and habitat. They provide for the viability of all terrestrial and aquatic species.

Alternative to Compare Viability for the Mexican Spotted Owl

Comments received on the proposed plan and DEIS recommended an alternative that would include the following: (1) implement standards and guidelines from the 1987 plan, (2) forbid new road construction in Mexican spotted owl protected activity centers (PACs), (3) incorporate fuel treatment concepts to minimize risk of stand-replacing fire in PACs, including large tree retention, management of surface fuels and sub-canopy forest structure, and spatial orientation of treatments, and (4) apply fuel treatment modeling in Mexican spotted owl habitat conducted by Northern Arizona University Forest Ecosystem Restoration Analysis. The intent of the alternative is to help the decisionmaker and the public compare impacts to Mexican spotted owl and its critical habitat.

This alternative was eliminated from detailed study because the implementation of 1987 plan standards and guidelines is considered in the alternative A analysis in the EIS. The plan provides direction that projects and activities would be managed consistent with the Mexican spotted owl recovery plan, including constraints on road construction and fuel treatments.

Methodologies for fuel treatment modeling would be determined by the responsible official on a site specific basis. The Northern Arizona University Forest Ecosystem Restoration Analysis may be used if determined applicable.

Alternative Proposed by Counties

Several Arizona counties (Gila, Graham, Greenlee, and Navajo) and the Eastern Arizona Counties Organization recommended a new alternative during the comment period for the proposed plan and DEIS. That alternative would have included provisions from existing alternatives to treat grasslands, increase logging, prioritize mechanical thinning over prescribed fire, consider more new motorized areas and trails in the future, prevent catastrophic wildfire, restore watersheds, and alter the designation of management areas. The alternative would also have proposed changes to rangeland management; support for local wood-based industries; guidance for TMR; guidelines to integrate the OGPLTRS; a comparison of the 10 priority watersheds; more clearly differentiating between degrading factors and their effects and between natural processes and management effects; providing more information on the proposed natural landscape areas; a rationale for proposed elimination of IRAs; more specific information on and plans for monitoring; and guidelines to integrate social and economic sustainability, science, and considerations into decision making.

This alternative was not considered for detailed study because several components were analyzed in alternatives in the EIS, or addressed in plan direction, or were beyond the scope of the plan and plan revision process. The suggested provisions from existing alternatives were analyzed as alternatives B and C in chapter 2 and 3 of the EIS. The plan provides a monitoring strategy in chapter 5.

The plan sets the framework for implementing TMR and the planning process for implementing TMR will address the issues of motorized big game retrieval, dispersed camping, firewood collection, and dispersed shooting. The plan's interdisciplinary team considered the OGPLTRS in its entirety, but recommended that it not be analyzed in detail. See the "Alternatives Considered but Eliminated from Detailed Study" section in chapter 2 of the EIS. The "Watershed" section in chapter 3 of the EIS was updated based on the recommendation to clarify degrading factors.

See the response to comment # 161.19 in the "Alternatives" section of appendix A for a complete explanation.

Alternatives Considered in Detail

In addition to the no action alternative (alternative A or the 1987 plan) and the proposed plan (alternative B), the Forest Service developed two additional action alternatives (alternatives C and D) to respond to issues raised by the public.

Elements Common to All Alternatives

All four alternatives have a number of features in common. In particular, they

- Comply with applicable laws, regulations, and policies (see appendix D of the proposed plan which accompanies this document)[5];
- Contain plan decisions including desired conditions (or goals), objectives, standards, guidelines, special areas, suitability, and monitoring;
- Share the same desired conditions for the resources of the Apache-Sitgreaves NFs. The desired conditions are described in detail in the proposed plan;
- Conserve soil and water resources and do not allow significant or permanent impairment of the productivity of the land;
- Provide protection for riparian areas;
- Maintain air quality that meets or exceeds applicable Federal, State, and/or local standards or regulations;
- Provide for and maintain diversity of plant and animal communities consistent with overall multiple-use objectives;
- Provide for species' viability by providing appropriate habitat that is well distributed across the planning area;
- Include measures for preventing the destruction or adverse modification of critical habitat for threatened and endangered species;
- Use a common list of management indicator species (MIS) and ecological indicators (EIs). The list of 17 MIS used in the 1987 plan was reviewed and modified (see the "Plan Set of Documents" for rationale). The following three MIS are used to compare and evaluate alternatives: Mexican spotted owl, northern goshawk, and pronghorn antelope. Aspen and riparian EIs are also used to compare and evaluate alternatives;
- Protect cultural resources;
- Recognize the unique status of American Indian tribes and their rights retained by trust and treaty with the U.S., including consultation requirements;
- Emphasize uneven-aged forest conditions, with allowance for some even-aged management, using a variety of vegetation management tools and methods;
- Use mechanical and wildland fire (planned and unplanned) treatments to meet desired conditions;
- During responses to wildland fire, risks to firefighters and the public are mitigated. Protection of human life overrides all other priorities;

[5] However, alternative C does not comply with the 2001 Roadless Area Conservation Rule. See the Inventoried Roadless Areas section on the following page for more information.

- Provide sustained multiple uses, products, and services (e.g., wood harvesting, grazing, recreation) in an environmentally acceptable manner;
- Protect the outstandingly remarkable values identified for the 23 eligible and 2 suitable wild and scenic rivers;
- Retain existing designated special areas (e.g., wilderness areas, Phelps Cabin Research Natural Area); and
- Manage the Blue Range Primitive Area and presidential additions as a primitive area until a congressional decision on wilderness is made.

Conformance with the Forest and Rangeland Renewable Resources Planning Act of 1974

The 1982 Planning Rule regulations at 219.12(f)(6) require land management plans to respond to and incorporate program objectives from the Renewable Resource Planning Act (RPA). The last RPA Program was developed in 1995. In lieu of the RPA Program, the Forest Service Strategic Plan 2007 to 2012 provides broad, overarching national guidance for forest planning and national objectives for the Agency as required by the Government Performance Results Act. All alternatives in this FEIS address these broad strategic objectives.

Inventoried Roadless Areas

Alternatives A, B, and D include management direction for inventoried roadless areas (IRAs) identified in the 2001 Roadless Area Conservation Rule (RACR) that retains the roadless character of these areas. In alternative C, these areas would be managed according to management area guidance with no direction to retain their roadless character.

During the plan revision process, there were two conflicting legal decisions concerning the status of IRAs. Because there was no resolution of the conflicting rulings at the time this analysis was initiated, the Forest Service included consideration of no IRAs and no IRA management in alternative C in response to public comments that requested full multiple-use of IRA lands. NEPA does allow the consideration of alternatives that may not be legal but address public concerns (40 CFR 1502.14(c)). During the analysis process, the Roadless Area Conservation Rule was upheld in federal court and alternative methods of IRA management, such as those considered in alternative C cannot be selected in the record of decision for the EIS.

Main Differences Among Alternatives

The alternatives differ in how they respond to the issues as identified in chapter 1 under the section “Issues that Served as the Basis for Alternative Development.” The alternatives also vary in the number of recommended research natural areas (RNAs). No issue drove the change in the number of recommended RNAs. The change was based on the theme of the alternative (for example, alternative D allocates some lands to recommended wilderness that could have been a recommended RNA).

See appendix J for management area maps of the alternatives.

Alternative A (1987 plan)

Under the no action alternative, the 1987 plan, as amended, would continue to guide management of the Apache-Sitgreaves NFs. Alternative A emphasizes timber management as a primary tool for providing forest products for local and regional industrial and individual needs while meeting wildlife habitat needs.

Priority for Restoration Treatments

Although not emphasized in the 1987 plan, current management emphasizes treatments around communities to reduce threats from wildfire and supply forest products through vegetation treatments, including the White Mountain Stewardship Project (a 10-year stewardship contract to thin primarily small diameter trees). Vegetation treatments have been implemented to restore forest health, reduce the risk of fire to communities, reduce the cost of forest thinning to taxpayers, support local economies, and encourage new wood product industries and uses for wood fiber. At least 20 percent of each forested and woodland PNVT is managed for, or toward, old growth.

Treatment Methods

Alternative A uses both mechanical and wildland fire treatments for timber management and to reduce threats to communities from wildfire.

On average, approximately 17,000 acres per year would be treated in the forested PNVTs, primarily ponderosa pine. Very few grassland areas would be treated, averaging around 500 acres per year. Approximately 3,500 acres per year of piñon-juniper and Madrean pine-oak woodlands would be treated, primarily with fire. No specific treatments are planned to improve ecological conditions in riparian areas; they would be treated as opportunities arise. There is no planned treatment objective for interior chaparral since this PNVT currently meets desired conditions; however, treatments may occur only as opportunities arise.

Wildlife Quiet Areas

There are eight areas (totaling 45,506 acres) implemented under special closure orders that are managed as wildlife habitat or quiet areas. While not a 1987 plan management area, these areas implement plan direction to benefit wildlife habitat, soil, vegetation, water resources, and recreation (improved hunting opportunities). These wildlife quiet areas include Beaver Turkey Ridge, Hulsey Bench, Middle Mountain, Open Draw, St. Peters Dome, Upper Coyote, Willow Springs-Horse Trap, and Woolhouse.

Recreation Opportunities

A variety of recreation opportunities are provided, including motorized, nonmotorized, developed, and dispersed. Construction of new recreation facilities to meet growing demand is an emphasis.

Figure 2 displays the Recreation Opportunity Spectrum (ROS) classes for alternative A: primitive (P), semi-primitive nonmotorized (SPNM), semi-primitive motorized (SPM), roaded natural

(RN), roaded modified (RM), rural (R), and urban (U). ROS is a framework for identifying the types of outdoor recreation opportunities on the forests that are available to the public. The ROS classes are described in the “Glossary.”

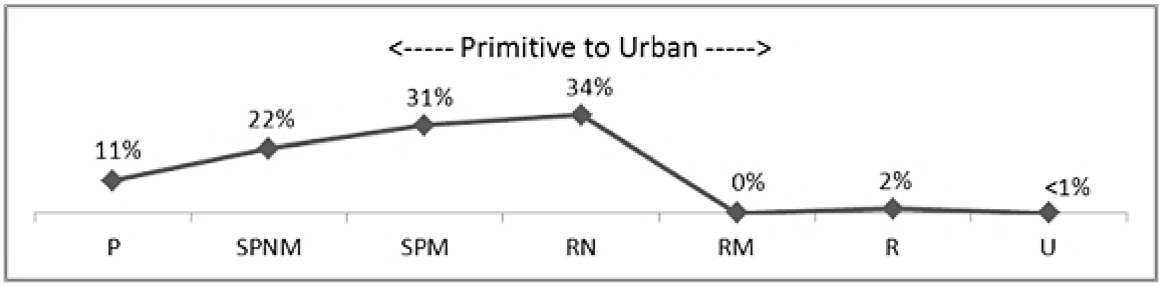

Figure 2. Recreation Opportunity Spectrum for alternative A

Recommended Wilderness

The 1987 plan does not recommend any additional lands for wilderness. In 1971, the Forest Service submitted a recommendation to the President of the United States for the Blue Range Wilderness in New Mexico and Arizona. Congress has not acted on the Arizona portion of this recommendation. Until Congress acts, the 1971 recommendation remains in place. The Blue Range Primitive Area and Additions Management Area is managed to protect wilderness values.

Contribution to Local Communities – Wood Product Availability

Alternative A has 764,872 acres of land managed for timber production on a regulated basis with planned, scheduled entries. It is estimated that an average of 205,000 CCF[6] of wood products, including sawlogs, biomass, and firewood, would be available annually for local and regional industry and individual use.

Research Natural Areas

The 1987 plan provides direction for one designated research natural area, Phelps Cabin RNA (approximately 290 acres). It recommends four new research natural areas totaling 2,569 acres: Escudilla, Thomas Creek, Wildcat, and Hayground. To date, these recommended areas have not been formally designated. In addition, there are approximately 100 acres managed as a botanical area, the Phelps Cabin Botanical Area.

Alternative B – Proposed Action (Preferred Alternative)

Alternative B is the proposed action (proposed plan) and the preferred alternative. This alternative was developed iteratively in a collaborative manner to address the need for change identified in chapter 1. It is designed to address the demands for wildlife habitat, community protection, commodity outputs, and recreation opportunities with an emphasis on ecological restoration.

[6] CCF = 100 cubic feet

Priority for Restoration Treatments

Treatments are focused in priority watersheds and locations identified in community wildfire protection plans, including the Community-Forest Intermix Management Area[7]. One of the main objectives of the proposed plan is to remove or mitigate degrading factors in at least 10 priority 6th level HUC (hydrologic unit code) watersheds within the next 10 to 15 years. Management emphasis is also to reduce the threat to communities from uncharacteristic wildfire.

The proposed plan emphasizes the retention and development of old growth where needed to meet desired conditions by including the guideline:

> "Where current forests are lacking proportional representation of late seral states and species composition on a landscape scale, old growth characteristics should be retained or encouraged to the greatest extent possible within the scope of other desired conditions (e.g., reduce impacts from insects and disease, reduce the threat of uncharacteristic wildfire)."

Treatment Methods

The proposed plan uses a mix of mechanical treatments and the reestablishment of natural processes, primarily wildland fire (both planned and unplanned ignitions), to maintain or move toward desired conditions of more resilient, healthy ecosystems.

Mechanical treatments would generally be followed by pile burning to remove residual fuels. As desired conditions are achieved, wildland fire or mechanical treatments may be used at regular intervals to maintain conditions. The proposed plan focuses restoration treatments in those PNVTs that are most divergent from desired conditions. There is an emphasis to treat forests, grasslands, and riparian areas; there is less emphasis on woodlands and chaparral.

The majority of treatments, from 5,000 to 35,000 acres per year, in the forested PNVTs would occur in ponderosa pine, although there would be treatments in all forested PNVTs. Additionally, up to 25,000 acres per year of grassland PNVTs (primarily Great Basin and semi-desert) would be treated to remove encroaching woody species. Approximately 5,000 to 15,000 acres per year of woodland PNVTs (primarily Madrean pine-oak using fire) and 200 to 500 acres per year of riparian areas would be treated to improve ecological conditions. There are no planned treatment objectives for interior chaparral since this PNVT currently meets desired conditions; however, treatments may occur as opportunities arise.

Wildlife Quiet Areas

In addition to the eight existing wildlife quiet areas (approximately 45,500 acres), this alternative adds two, Bear Springs and Cottonwood Seep, for a total of 50,173 acres. Unlike alternative A, all wildlife quiet areas in this alternative are assigned to a management area. Direction for these areas is found in the Wildlife Quiet Area Management Area.

[7] The Community-Forest Intermix Management Area makes up a portion of the wildland-urban interface (WUI). WUIs were identified in community wildfire protection plans (CWPPs) and may be located in several management areas. A WUI includes areas around human development at imminent risk from wildfire.

Recreation Opportunities

A variety and mix of recreation opportunities continue to be provided. New recreation developments are limited; the emphasis is on maintaining existing developments.

Figure 3 displays the Recreation Opportunity Spectrum (ROS) classes for alternative B: primitive (P), semi-primitive nonmotorized (SPNM), semi-primitive motorized (SPM), roaded natural (RN), roaded modified (RM), rural (R), and urban (U). ROS is a framework for identifying the types of outdoor recreation opportunities on the forests that are available to the public. The ROS classes are described in the "Glossary."

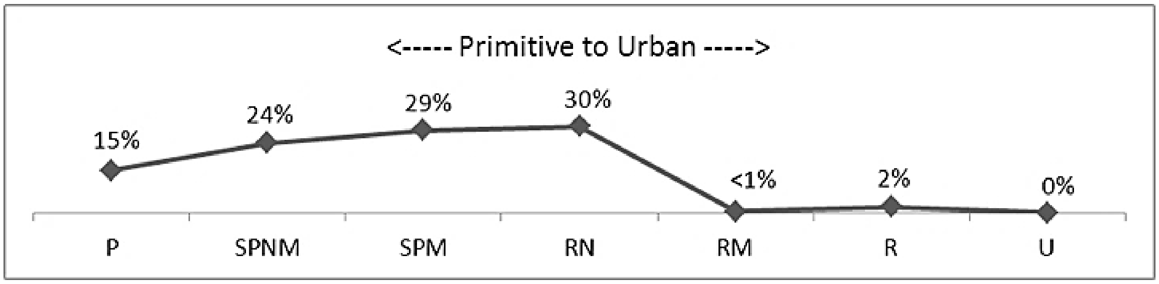

Figure 3. Recreation Opportunity Spectrum for alternative B

Recommended Wilderness

Alternative B recommends 7,074 acres for wilderness (figure 88 in appendix J). This includes additions to both Escudilla (6,813 acres) and Bear Wallow (261 acres) Wilderness areas. These preliminary administrative recommendations would receive further review, including applicable NEPA analyses, and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Congress has reserved the authority to make final decisions on wilderness designation. These areas are managed to protect wilderness values. In this alternative, recommended wilderness is not suitable for mechanized travel (e.g., mountain bike use would not be allowed). The Blue Range Primitive Area continues to be managed as a primitive area until Congress acts on the 1971 wilderness recommendation.

Contribution to Local Communities – Wood Product Availability

The proposed plan identifies 596,744 acres of land to be managed for timber production on a regulated basis with planned, scheduled entries. Most commodities, such as sawlogs, biomass, and firewood, would be available as a result of restoration treatments. It is estimated that an average of 263,000 CCF of wood products would be available annually for local and regional industry and individual use as a byproduct of restoration treatments.

Research Natural Areas

The proposed plan carries forward the designated research natural area, Phelps Cabin RNA (approximately 290 acres) and recommends adding the Phelps Cabin Botanical Area (approximately 100 acres) to it as a recommended RNA. In addition, this alternative recommends designating five new research natural areas totaling 7,814 acres: Thomas Creek, Corduroy, Three Forks, Lower Campbell Blue, and Sandrock. Thomas Creek is currently managed as a recommended RNA under the 1987 plan. This alternative would withdraw existing RNA recommendations for Escudilla Mountain, Wildcat, and Hayground.

Alternative C

Alternative C responds to public comments that forest management should provide increased benefits to local communities through management emphasis on commodity outputs and motorized and developed recreation. There is an emphasis on contributing to local and regional economic sustainability through ecological restoration.

Priority for Restoration Treatments

Alternative C focuses treatments in the Community-Forest Intermix Management Area, forests suitable for timber production, woodlands, and those grasslands encroached by woody species. There is an emphasis on reducing the threat to communities from uncharacteristic wildfire and on tree removal to contribute to commercial uses.

To provide additional opportunities to meet forest products desired conditions, alternative C does <u>not</u> include the following guideline that appears in the proposed plan (alternative B).

> "Where current forests are lacking proportional representation of late seral states and species composition on a landscape scale, old growth characteristics should be retained or encouraged to the greatest extent possible within the scope of other desired conditions (e.g., reduce impacts from insects and disease, reduce the threat of uncharacteristic wildfire)."

Treatment Methods

Alternative C primarily uses mechanical treatment methods, with less wildland fire than alternative B, to maintain or move toward desired conditions of more resilient, healthy ecosystems. Mechanical treatments would generally be followed by pile burning to remove residual fuels. As desired conditions are achieved, wildland fire or mechanical treatments may be used at regular intervals to maintain conditions. Restoration treatments are focused in forests, woodlands, and encroached montane/subalpine grasslands where there are commercial uses for trees removed. There is less emphasis to treat other grasslands, riparian areas, and chaparral.

The majority of treatments, from 5,500 to 55,000 acres per year, in the forested PNVTs would occur in ponderosa pine, although there would be treatments in all forested PNVTs. In addition, approximately 2,500 to 10,000 acres per year of woodland PNVTs would be treated using mainly mechanical treatments in piñon-juniper and fire in Madrean pine-oak. About 500 acres per year of montane/subalpine grasslands PNVT would be treated to remove encroaching woody species. No treatment acres are planned in riparian areas; they would be treated as opportunities arise. There are no planned treatment objectives for interior chaparral since this PNVT currently meets desired conditions; however, treatments may occur as opportunities arise.

Wildlife Quiet Areas

All eight existing wildlife quiet areas are carried forward in alternative C for a total of 44,373 acres, although Beaver Turkey Ridge and Willow Springs-Horse Trap would be slightly smaller due to the configuration of other management areas. Unlike alternative A, all wildlife quite areas in this alternative are assigned to a management area. Direction for these areas is found in the Wildlife Quiet Area Management Area.

Recreation Opportunities

A variety of recreation opportunities continue to be provided with an emphasis on motorized and developed opportunities. New recreation facilities would be considered where there is a need to meet increasing demand.

Figure 4 displays the Recreation Opportunity Spectrum (ROS) classes for alternative C: primitive (P), semi-primitive nonmotorized (SPNM), semi-primitive motorized (SPM), roaded natural (RN), roaded modified (RM), rural (R), and urban (U). ROS is a framework for identifying the types of outdoor recreation opportunities on the forests that are available to the public. The ROS classes are described in the "Glossary."

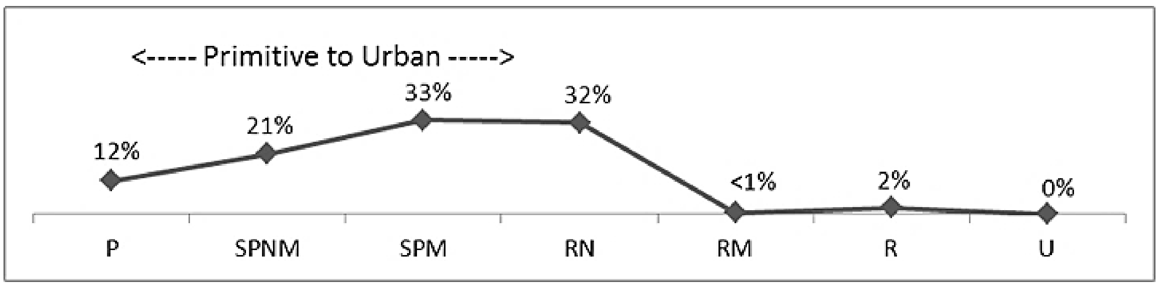

Figure 4. Recreation Opportunity Spectrum for alternative C

Recommended Wilderness

Alternative C recommends additions to Escudilla Wilderness totaling 6,982 acres (figure 90 in appendix J). This area is slightly larger than the alternative B addition to Escudilla Wilderness. These preliminary administrative recommendations would receive further review, including applicable NEPA analyses, and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Congress has reserved the authority to make final decisions on wilderness designation. These areas are managed to protect wilderness values. In this alternative, recommended wilderness is not suitable for mechanized travel (e.g., mountain bike use would not be allowed). The Blue Range Primitive Area continues to be managed as a primitive area until Congress acts on the 1971 wilderness recommendation.

Contribution to Local Communities – Wood Product Availability

Alternative C identifies 604,746 acres of land to be managed for timber production on a regulated basis with planned, scheduled entries. Commodities such as sawlogs, biomass, and firewood would be available as a result of restoration treatments. It is estimated that an average of 416,000 CCF of wood products would be available annually for local and regional industry and individual use as a byproduct of restoration treatments.

Research Natural Areas

Alternative C carries forward the designated research natural area, Phelps Cabin RNA (approximately 290 acres), and recommends adding the Phelps Cabin Botanical Area (approximately 100 acres) to it as a recommended RNA. In addition, this alternative recommends designating five new research natural areas: Thomas Creek, Corduroy, Three Forks, Lower Campbell Blue, and Sandrock totaling 7,814 acres. Thomas Creek is currently managed as a recommended RNA under the 1987 plan. This alternative would withdraw existing RNA recommendations for Escudilla Mountain, Wildcat, and Hayground.

Alternative D

Alternative D responds to public comments that forest management should emphasize more natural processes and nonmotorized and dispersed recreation opportunities. There is an emphasis on ecological restoration in all PNVTs.

Priority for Restoration Treatments

Treatments are focused in priority watersheds. One of the primary objectives of alternative D is to remove or mitigate degrading factors in at least 10 priority 6^{th} level HUC watersheds within the next 10 to 15 years.

This alternative emphasizes the retention of old growth and large trees. It includes the following standard for forested and woodland PNVTs in all management areas, except the Community-Forest Intermix Management Area:

> "Retain all large and old trees regardless of size or condition."

In the forested PNVTs, large trees are generally 16 inches in diameter or larger. In the woodland PNVTs, large trees are considered to be generally 20 inches in diameter or larger. Trees are considered to be old if they predate Euro-American settlement (middle to late 1800s).

Treatment Methods

Alternative D emphasizes natural processes, primarily wildland fire (planned and unplanned ignitions), with limited mechanical treatments to maintain or move toward the desired conditions of more resilient, healthy ecosystems. Where mechanical treatments are used, they generally would be followed by pile burning to remove residual fuels. As desired conditions are achieved, wildland fire would be the primary tool used at regular intervals to maintain conditions. Restoration treatments are distributed among all PNVTs in riparian areas, forests, grasslands, and woodlands.

Mechanical treatments would be used around communities in the Community-Forest Intermix Management Area and, in some cases, as pretreatment for prescribed fire. The majority of treatments, from 7,500 to 50,000 acres per year, in the forested PNVTs would occur in ponderosa pine, although there would be emphasis to treat all forested PNVTs. Additionally, up to 24,000 acres per year of grassland PNVTs would be treated to remove encroaching woody species in all grassland types. Approximately 5,000 to 30,000 acres per year of woodland PNVTs (primarily Madrean pine-oak using fire) and 300 to 600 acres per year of riparian areas would be treated to improve ecological conditions. There are no planned treatment objectives for interior chaparral since this PNVT currently meets desired conditions; however, treatments may occur as opportunities arise.

Wildlife Quiet Areas

Alternative D includes seven of the eight existing wildlife quiet areas (minus Hulsey Bench) plus five more, Bear Springs, Cottonwood Seep, Carr Lake, Palomino, and Hidden Lake, for a total of 58,379 acres. Unlike alternative A, all wildlife quite areas in this alternative are assigned to a management area. Direction for these areas is found in the Wildlife Quiet Area Management Area.

Recreation Opportunities

A variety of recreation opportunities continue to be provided, with an emphasis on dispersed and nonmotorized opportunities. There is no emphasis on building new highly developed recreation facilities; however, recreation development that provides for dispersed recreation (e.g., trailheads, wildlife viewing areas, trails) may occur.

Figure 5 displays the Recreation Opportunity Spectrum (ROS) classes for alternative D: primitive (P), semi-primitive nonmotorized (SPNM), semi-primitive motorized (SPM), roaded natural (RN), roaded modified (RM), rural (R), and urban (U). ROS is a framework for identifying the types of outdoor recreation opportunities on the forests that are available to the public. The ROS classes are described in the “Glossary.”

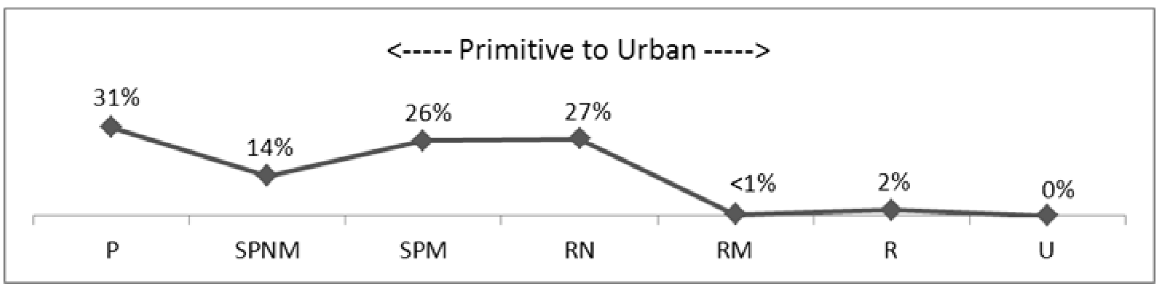

Figure 5. Recreation Opportunity Spectrum for alternative D

Recommended Wilderness

Alternative D recommends a total of 688,170 acres for wilderness (figures 91 and 92 in appendix J) on the Apache-Sitgreaves NFs. This includes 23 new stand-alone areas; 10 additions to Escudilla, Bear Wallow, and Mount Baldy Wilderness areas; and 2 additions to the Blue Range Primitive Area (484,714 acres)[8]. It also recommends almost all of the Blue Range Primitive Area and presidential additions (196,868 acres) for wilderness.

The alternative D recommendation includes three areas (Leonard Canyon, Centerfire, and West Blue/San Francisco) that extend onto other national forests. Small portions of these areas overlap the Coconino (2,981 acres) and Gila (3,607 acres) NFs; these 6,588 acres are included in the above total. These areas are recommended under the Apache-Sitgreaves NFs’ plan because most

[8] Acreages were misprinted in DEIS and are correct here. All analyis in chapter 3 was done with these corrected acreages.

of the recommended acres are administered by the Apache-Sitgreaves NFs and the forests led the wilderness evaluation process. For more details, see the “Wilderness Resources” section in chapter 3.

These preliminary administrative recommendations would receive further review, including applicable NEPA analyses, and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Congress has reserved the authority to make final decisions on wilderness designation. These areas are managed to protect wilderness values. In this alternative, recommended wilderness is suitable for mechanized travel (e.g., mountain bike use would be allowed). The Blue Range Primitive Area continues to be managed as a primitive area until Congress acts on the 1971 wilderness recommendation or this new recommendation.

Contribution to Local Communities – Wood Product Availability

Alternative D contains no land managed for timber production on a regulated basis. However, it is estimated that an average of 118,000 CCF of wood products including sawlogs, biomass, and firewood would be available annually for local and regional industrial and individual needs as a byproduct of restoration treatments.

Research Natural Areas

Alternative D carries forward the designated research natural area, Phelps Cabin RNA (approximately 290 acres), and recommends adding the Phelps Cabin Botanical Area (approximately 100 acres) to it as a recommended RNA. In addition, this alternative recommends designating two new research natural areas: Corduroy and Three Forks totaling 5,957 acres. This alternative would withdraw existing RNA recommendations for Escudilla Mountain, Wildcat, Hayground, and Thomas Creek.

Elements Common to All Action Alternatives

The three action alternatives (alternatives B, C, and D) have the following 13 areas of similarity:

1. Management Areas

A management area is used to allocate land for a unique emphasis. All action alternatives use the same basic set of 12 management areas (alternative A uses a set of 17 management areas). The alternatives differ in the total acreages and locations of the management areas.

Descriptions of the management areas considered in the action alternatives can be found in appendix D. Appendix D also includes descriptions of the management areas found in alternative A (1987 plan). Maps of the management areas can be found in appendix J.

2. Suitability

The criteria for the suitability of various uses (e.g., livestock grazing, timber production) are the same in all action alternatives. However, when the criteria are applied to the different alternatives, there may be variations in the amount of land suitable for certain uses (e.g., if an alternative has more land in the Natural Landscape Management Area, there could be less land suitable for timber production). The suitability criteria can be found in chapter 4 of the proposed plan.

3. Standards and Guidelines

The action alternatives share the same standards and guidelines (i.e., constraints on project-level decisions). Where they do not, the differences are highlighted in the above alternative descriptions. The standards and guidelines can be found in chapters 2 and 3 of the proposed plan.

4. Monitoring Strategy

All action alternatives include the same monitoring strategy as identified in chapter 5 of the proposed plan.

5. Wildlife and Fish

The action alternatives provide fish and wildlife habitat to help maintain species' populations of existing native and desirable nonnative species. They further contribute to species' needs by providing wildlife quiet areas and other management areas with limited disturbance (e.g., designated and recommended wilderness, natural landscape, designated and recommended research natural area). The amount (acres) of these areas varies by alternative.

6. Invasive Species

Each action alternative provides direction to control, treat, or eradicate invasive plant and animal species.

7. Other Special Areas

The action alternatives provide management direction for those existing special areas not mentioned in the 1987 plan (e.g., Heber Wild Horse Territory, scenic byways, national recreation trails). They also include direction for the 25 eligible or suitable wild and scenic rivers.

8. Motorized Cross-Country Travel

The action alternatives limit motorized travel to a system of NFS roads and NFS trails[9]. They do not allow motorized cross-country travel, except where allowed by a written authorization (e.g., permit, right-of-way) issued under Federal law or regulation or in designated motorized areas. The action alternatives do not designate motorized areas nor do they make changes to the current system of NFS roads or NFS trails. Any new designated motorized cross-country areas or changes to roads or trails would be evaluated in a separate NEPA decision.

Alternative A does allow motorized cross-country travel[10].

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[9] As identified in the I-WEB database (2012c), there are approximately 2,900 miles of roads and trails open for public or administrative use.

[10] Since alternative A allows motorized cross-country travel, if the responsible official selects alternative A, upon completion of the separate travel management planning process, the plan would be amended to limit motorized travel to designated roads, trails, and areas.

The proposed plan provides the framework to guide future changes to the transportation system. Once the final decision on the proposed plan has been made, potential changes to the forests' transportation system will be evaluated under the plan's framework and through implementation of the Travel Management Rule (36 CFR § 212)[11]. Upon completion of travel management planning, the associated motor vehicle use map (MVUM) will be printed. The MVUM will display the roads, trails, and areas that are designated for motorized vehicle use. Use inconsistent with those designations and inconsistent with this plan would be prohibited.

9. Threat to Communities from Wildfire

The action alternatives include the Community-Forest Intermix Management Area (1/2 mile buffer around communities at risk) to denote where fuels reduction treatments and maintenance are emphasized.

10. Landscape Scale Disturbance Events

The action alternatives include direction to be used following landscape scale (greater than 10,000 acres) disturbance events. These alternatives include standards and guidelines to protect existing resources and facilitate recovery of soil and vegetation components and improve ecosystem health.

11. Livestock Grazing

The action alternatives provide similar guidance for managing livestock grazing. The management focus is to "balance livestock grazing with available forage" on suitable grazing lands. The criteria for the suitability of livestock grazing are the same in all action alternatives. The amount of land suitable for livestock grazing would vary slightly among the action alternatives based on the number of recommended RNAs.

12. Urban Interface Demands

The action alternatives provide similar guidance (e.g., standards, guidelines) for addressing urban interface demands and land ownership adjustments.

13. New Energy Development

The action alternatives provide similar guidance (e.g., standards, guidelines, suitability criteria) for the existing energy corridors and for establishing new energy corridors or developments. The acres of land suitable for consideration of new energy developments vary among the action alternatives.

Comparison of Alternatives

This section provides a comparison of alternatives. The information focuses on activities and environmental consequences where differences among alternatives can be distinguished

[11] The Travel Management Rule was created to help address unmanaged motorized vehicle use. It requires each national forest to designate a system of roads, trails, and areas open to motor vehicles where OHVs and other motor vehicles can be used. Once the system is designated, the rule will prohibit motor vehicle use off the designated system.

quantitatively or qualitatively. It includes a comparison of management area allocations, indicators[12], and other information.

It should be noted that acreages and mileages listed in the FEIS are approximate. They were calculated using the most current data available in the Apache-Sitgreaves NFs' Geographic Information System (GIS). As the GIS database is updated, these measurements may change.

Comparison of Management Areas

Tables 1 and 2 identify the acreage and percentage of each management area that make up each alternative. Descriptions of the management areas can be found in appendix D. Note that alternative A (1987 plan) uses a different set of management areas than the action alternatives; a crosswalk comparison can be found in appendix D.

Table 1. Management area allocation (acres and percent) for the no action alternative

Management Area[a]	Acres[b]
Forest Land	865,473 (43%)
Woodland	766,495 (38%)
Grasslands	52,409 (3%)
Riparian	42,645 (2%)
Water	4,071 (<1%)
Escudilla Demonstration Area	4,898 (<1%)
Sandrock	26,596 (1%)
Research Natural Area	2,549 (<1%)
Developed Recreation Sites	(<1%)[c]
Black River	6,804 (<1%)
Chevelon Canyon	10,643 (1%)
West Fork Black River	9,066 (<1%)
East and West Forks Little Colorado River	1,927 (<1%)
Blue Range Primitive Area	199,505 (10%)
Bear Wallow Wilderness	11,234 (1%)
Escudilla Wilderness	4,195 (<1%)[d]
Mount Baldy Wilderness	6,842 (<1%)
Total acres	2,015,352

[a]See appendix D for descriptions of management areas.

[b]Acres are derived from the most current data available in the Apache-Sitgreaves NFs GIS database; they may differ from the amount stated in the 1987 plan due to mapping techniques and changes in land ownerships.

[c] Developed recreation sites management area was not discretely mapped.

[d] Escudilla Wilderness does not reflect acreage of Escudilla Mountain RNA

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[12] Indicators are quantitative or qualitative measures used to describe differences between alternatives.

Table 2. Management area allocation (acres and percent) for the action alternatives

Management Area[a]	Alt. B	Alt. C	Alt. D
General Forest	1,224,071 (61%)	1,599,357 (79%)	1,068,718 (53%)
Community-Forest Intermix	60,564 (3%)	60,564 (3%)	58,610 (3%)[b]
High Use Developed Recreation Area	16,549 (1%)	16,549 (1%)	16,549 (1%)
Energy Corridor	2,547 (<1%)	2,547 (<1%)	2,550 (<1%)[c]
Wild Horse Territory[d]	18,761 (1%)	18,761 (1%)	18,761 (1%)
Wildlife Quiet Area	50,173 (2%)	44,373 (2%)	59,379 (3%)
Natural Landscape	404,802 (20%)	35,408 (2%)	77,119 (4%)
Recommended Research Natural Area	7,814 (<1%)	7,814 (<1%)	5,957 (<1%)
Research Natural Area	261 (<1%)	261 (<1%)	261 (<1%)
Primitive Area[e]	199,502 (10%)	199,502 (10%)	199,502 (10%)[f]
Recommended Wilderness	7,074 (<1%)	6,982 (<1%)	484,712 (24%)
Wilderness	23,234 (1%)	23,234 (1%)	23,234 (1%)
Total acres	2,015,352	2,015,352	2,015,352

[a] See appendix D for descriptions of management areas.

[b] A portion of the land allocated to the Community-Forest Intermix Management Area in other alternatives is recommended for wilderness in alternative D.

[c] The Energy Corridor Management Area acreage for alternative D is slightly greater than alternatives B and C because three small isolated parcels containing a road could not be included in the adjacent Recommended Wilderness Management Area.

[d] The Wild Horse Territory, as designated by Congress, is approximately 19,700 acres; the difference in management area acres is due to the overlapping Community-Forest Intermix Management Area.

[e] In 1971, the Forest Service submitted a recommendation to the President of the United States for the Blue Range Wilderness in New Mexico and Arizona. The President forwarded the recommendation to Congress, who eventually acted on a portion of the recommendation. In 1980, Congress designated, and the President signed into law, the Blue Range Wilderness in New Mexico. The Arizona portion of the presidential recommendation (166,591 acres) included 20,031 acres outside and along the west primitive area boundary. The Forest Service and presidential recommendations for the Blue Range Wilderness in Arizona have not been acted upon.

[f] The majority of this area, except the road corridor, is also recommended for wilderness.

Comparison by Indicators

This section compares indicators of the need for change and issues for the four alternatives. Unless otherwise noted, the timeframe is the planning period and the outcomes are based on the average level of treatments identified in each alternative's objectives. Table values are approximations.

Table 3. Comparison of indicators by alternative

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Type, priority, and amount of restoration treatments				
Primary methods of restoration treatments	A mix of mechanical and wildland fire	A mix of mechanical and wildland fire	Primarily mechanical, some wildland fire	Primarily wildland fire, some mechanical
Priority[b] (emphasis) for restoration treatments	-Treat areas around communities to reduce the threat from uncharacteristic wildfire. -Provide wood products for the White Mountain Stewardship Project. -Old growth characteristics are retained and/or encouraged.	-Treat priority 6th level HUC watersheds. -Treat areas identified in community wildfire protection plans (CWPPs), including the Community-Forest Intermix Management Area to reduce the threat from uncharacteristic wildfire. -Wood products are available as a result of restoration treatments. -Old growth characteristics are retained and encouraged.	-Treat the Community-Forest Intermix Management Area to reduce the threat from uncharacteristic wildfire. -Treat lands suitable for timber production plus other forests, woodlands, and grasslands that can supply wood products. -Does not contain guidance to retain and encourage old growth characteristics.	-Treat priority 6th level HUC watersheds. - Treat the Community Forest Intermix Management Area to reduce the threat from uncharacteristic wildfire. -Wood products are available as a result of restoration treatments. -All large and old trees are retained, except in the Community-Forest Intermix Management Area.
Number of priority 6th level HUC watersheds where condition class is improved by removing or mitigating degrading factors	Opportunity[c]	10 per planning period		

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Amount of treatments to enhance or restore priority 6th level HUC watersheds	Opportunity	350 acres per year	350 acres per year	350 acres per year
Amount of treatments in forests (ponderosa pine, dry mixed conifer, wet mixed conifer, and spruce-fir)	17,000 acres per year primarily in ponderosa pine	5,000 to 35,000 acres per year primarily in ponderosa pine	5,500 to 55,000 acres per year primarily in ponderosa pine	7,500 to 50,000 acres per year primarily in ponderosa pine
Amount of treatments in woodlands (Madrean pine-oak and piñon-juniper)	3,500 acres per year in both types primarily using wildland fire	5,000 to 15,000 acres per year primarily in Madrean pine-oak using wildland fire	2,500 to 10,000 acres per year primarily mechanical in piñon-juniper and wildland fire in Madrean pine-oak	5,000 to 30,000 acres per year primarily in Madrean pine-oak using wildland fire
Amount of treatments in grasslands (semi-desert, Great Basin, and montane/subalpine)	500 acres per year	Up to 25,000 acres per year primarily in Great Basin and semi-desert	500 acres per year in montane/subalpine Other grasslands as opportunities arise	Up to 24,000 acres per year throughout all grassland types
Amount of treatments in interior chaparral	Opportunity	Opportunity	Opportunity	Opportunity
Amount of treatments in riparian areas to move toward desired composition, structure, and function	Opportunity	200 to 500 acres per year	Opportunity	300 to 600 acres per year
Minimum amount of NFS roads or trails that negatively impact streams or riparian areas to be relocated, repaired, improved, or decommissioned	Opportunity	4 miles per planning period	Opportunity	4 miles per planning period
Average amount of unauthorized roads or trails that negatively impact streams or riparian areas to be removed	Opportunity	2 miles per year	3 miles per year	3 miles per year
Amount of wet meadows or cienegas restored	Opportunity	5 to 25 per planning period	Opportunity	5 to 25 per planning period
Amount of stream and riparian habitat treatments to restore structure, composition, and function of physical habitat for native fisheries and riparian-dependent species	Less than 10 miles per year	5 to 15 miles per year	Opportunity	5 to 15 miles per year

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Average amount of riparian habitat treated to reduce animal damage to native willows and other riparian species	Opportunity	5 miles per year	5 miles per year	5 miles per year
Minimum number of projects to provide for aquatic and riparian-associated species and migratory species	Opportunity	5 per planning period	Opportunity	5 per planning period
Amount of treatments to contain, control, or eradicate terrestrial invasive species	500 acres per year	500 to 3,500 acres per year	500 to 3,500 acres per year	500 to 3,500 acres per year
Minimum amount of treatments to contain, control, or eradicate aquatic invasive species	Opportunity	2 miles per year	2 miles per year	2 miles per year
Minimum number of unneeded structures removed to improve wildlife connectivity	Opportunity	5 per year	5 per year	5 per year
Average number of dispersed campsites rehabilitated, stabilized, revegetated, or relocated	Opportunity	5 per year	5 per year	5 per year
Departure rating from desired conditions by PNVT, based on the average treatment objectives	**(see the "Vegetation" section in chapter 3)**			
Ponderosa pine forest	High	High	Moderate	High
Dry mixed conifer forest	Moderate	Moderate	Moderate	High
Wet mixed conifer forest	Moderate	Moderate	Moderate	Moderate
Spruce-fir forest	High	High	High	High
Piñon-juniper woodland	Low	No Departure	No Departure	No Departure
Madrean pine-oak woodland	Moderate	Moderate	Moderate	Moderate
Great Basin grassland	High	No	High	No
Semi-desert grassland	Severe	High	Severe	High

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Benefit to maintenance and reproduction of aspen	**(see the "Vegetation" section in chapter 3)**			
Amount of aspen on the landscape (desired condition is at least 50,000 acres)	71,100 acres	68,200 acres	65,800 acres	65,500 acres
Trend of riparian conditions and function toward proper functioning condition	**(see the "Riparian" section in chapter 3)**			
Trend of riparian condition and function	Away	Toward	Away	Toward
Percent of grasslands where encroachment of woody canopy is reduced to less than 10 percent	**(see the "Vegetation" section in chapter 3)**			
Amount of Great Basin and semi-desert grasslands where woody species encroachment is reduced	1%	46%	1%	42%
Probability of nuisance smoke impacts to communities	**(see the "Fire" section in chapter 3)**			
Probability of short-term smoke impacts from wildland fire (planned and unplanned ignitions)	Least	High	Moderate	Highest
Probability of long-term smoke impacts from uncharacteristic wildfires	Highest	Moderate	High	Least
Number and acres of wildlife quiet areas	**(see the "Wildlife and Rare Plants" section in chapter 3)**			
Number of wildlife quiet areas	8 areas	10 areas	8 areas	12 areas
Amount of wildlife quiet areas	45,500 acres	50,200 acres	44,400 acres	59,400 acres

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Acres and percent of the Apache-Sitgreaves NFs by Recreation Opportunity Spectrum (ROS) classification	**(see the “Recreation” section in chapter 3)**			
Primitive (P)	228,954 acres (11%)	295,934 acres (15%)	232,233 acres (12%)	620,879 acres (31%)
Semiprimitive Nonmotorized (SPNM)	452,486 acres (22%)	487,747 acres (24%)	422,932 acres (21%)	279,050 acres (14%)
Semiprimitive Motorized (SPM)	614,520 acres (31%)	575,572 acres (29%)	662,116 acres (33%)	527,725 acres (26%)
Roaded Natural (RN)	686,435 acres (34%)	603,887 acres (30%)	645,056 acres (32%)	539,491 acres (27%)
Roaded Modified (RM)	0 acres (0%)	9,682 acres (<1%)	9,682 acres (<1%)	7,149 acres (<1%)
Rural (R)	32,853 acres (2%)	42,530 acres (2%)	43,333 acres (2%)	41,058 acres (2%)
Urban (U)	104 acres (<1%)	0 acres (0%)	0 acres (0%)	0 acres (0%)
Acres and percent of the Apache-Sitgreaves NFs designated wilderness, primitive area, and recommended for wilderness	**(see the “Wilderness Resources” section in chapter 3)**			
Amount of designated wilderness	23,234 acres[d] (1%)	23,234 acres[d] (1%)	23,234 acres[d] (1%)	23,234 acres[d] (1%)
Amount of primitive area[e]	199,505 acres (10%)	199,502 acres (10%)	199,502 acres (10%)	199,502 acres (10%)
Amount of recommended wilderness	0 acres (0%)	7,074 acres (0.4%)	6,982 acres (0.3%)	484,712 acres[f] (24%)

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Additional areas recommended for wilderness[g]	0 acres (0%)	0 acres (0%)	0 acres (0%)	196,868 acres[h] (10%)
Number and acres of designated and recommended research natural areas (RNAs)	**(see the “Research Natural Area section in chapter 3)**			
Number of designated RNAs	1	1	1	1
Number of recommended RNAs	4	6	6	3
Amount of designated and recommended RNAs (percent of NFS land)	2,549 acres (<1%)	8,075 acres (<1%)	8,075 acres (<1%)	6,218 acres (<1%)
Acres and percent of the Apache-Sitgreaves NFs by Scenic Integrity Level (SIL)	**(see the “Scenic Resources” section in chapter 3)**			
Very high scenic integrity (unaltered)	210,769 acres (11%)	305,047 acres (15%)	303,723 acres (15%)	748,716 acres (37%)
High scenic integrity (appears unaltered)	490,464 acres (25%)	786,776 acres (39%)	676,394 acres (34%)	444,302 acres (22%)
Moderate scenic integrity (slightly altered)	835,979 acres (42%)	920,648 acres (46%)	1,032,351 acres (51%)	819,449 acres (41%)
Low scenic integrity (moderately altered)	405,470 acres (20%)	394 acres (<1%)	394 acres (<1%)	393 acres (<1%)
Very low scenic integrity (heavily altered)	35,008 acres (2%)	2,490 acres (<1%)	2,490 acres (<1%)	2,492 acres (<1%)
Economic contributions of forest management	**(see the “Socioeconomic Resources” section in chapter 3)**			
Average labor income generated	$117,600,000	$118,400,00	$129,300,000	$112,400,000
Average number of jobs contributed	3,768	3,793	4,120	3,610
Average present net value	-$26,800,000	-$26,400,000	-$17,000,000	-$28,200,000

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Acres and percent of Apache-Sitgreaves NFs that are suitable for timber production	**(see the "Forest Products" section in chapter 3)**			
Amount of land suitable for timber production on a regulated basis	764,900 acres (38.0%)	596,700 acres (29.6%)	604,700 acres (30.0%)	0 acres (0%)
Annual average amount of sawtimber, pulp, and poles (5 inch or greater diameter)	**(see the "Forest Products" section in chapter 3)**			
Average amount of sawtimber, pulp, and poles (5 inch or greater diameter)	80,000 CCF	84,000 CCF	171,000 CCF	27,000 CCF
Annual average amount of firewood available	**(see the "Forest Products" section in chapter 3)**			
Average amount of firewood available	26,000 CCF	75,000 CCF	35,000 CCF	46,000 CCF
Annual average amount (tons) of biomass available	**(see the "Forest Products" section in chapter 3)**			
Average amount of biomass available	348,000 tons	364,000 tons	733,000 tons	156,000 tons
Acres and percent of Apache-Sitgreaves NFs suitable for new energy corridors or development	**(see the "Lands and Special Uses" section in chapter 3)**			
Amount of land suitable for new energy corridors or development	NA (NA)	889,700 acres (44%)	1,007,500 acres (50%)	784,400 acres (39%)

[a] Alternative A, the no action alternative, has a different set of management areas than the action alternatives; a crosswalk, found in appendix D, was used so the alternatives could be compared.

[b] The priority or emphasis of where treatments would occur varies by alternative.

[c] Opportunity indicates that there would be no set objective for this alternative; treatments and accomplishments would occur as opportunities arise and conditions, funding, and staffing allow.

[d] Alternative A acres include the Escudilla Wilderness Management Area and a part of the Research Natural Area Management Area (Escudilla Mountain RNA) that is within the designated wilderness.

[e] Acres in the primitive area differ between alterantive A and the action alternatives due to improved mapping techniques (i.e., mapping from the 1987 plan map compared to mapping with aerial photography as reference).

[f] Alternative D also recommends 2,981 acres on the Coconino NF and 3,607 acres on the Gila NF.

[g] There is a 1971 presidential wilderness recommendation of the Blue Range Primitive Area and additions that Congress has not acted upon. The Blue Range Primitive Area must be managed as a primitive area until Congress acts on the 1971 wilderness recommendation.

[h] Alternative D would recommend the majority of the Primitive Area Management Area, except the road corridor, for wilderness designation.

Comparison of Other Plan Objectives

This section compares other plan objectives for the four alternatives.

Table 4. Other plan objectives

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Minimum number of new wildlife viewing opportunities created	Opportunity	10 per	planning	period
Provision of accessible and wildlife-resistant trash facilities in all developed sites where trash is collected	Opportunity	Within	planning	period
Percent of developed recreation deferred maintenance backlog reduced	Opportunity	10% per	planning	period
Percent of NFS roads maintained		20% of passenger high-clearance	vehicle roads vehicle roads	and 10% of per year
Percent of NFS motorized trails maintained			20% per year	
Percent of NFS nonmotorized trails maintained			20% per year	
Removal of the National Recreation Trail designation from the Escudilla trail to conform with agency policy	Initiate	process within 5	years of plan	approval
Average number of projects accomplished to enhance scenic resources	Opportunity		5 per year	
Average number of miles of NFS boundary surveyed and posted	Opportunity		2 to 5 miles per year	
Average number of miles of NFS property boundary posted and corner monuments placed	Opportunity		2 to 5 miles per year	
Average number of existing trespass cases resolved	Opportunity		3 per year	
Schedule for inspecting National Register sites and priority cultural resources	Opportunity	Every 2 years or Region Heritage	according to SW Program	
Minimum number of eligible cultural resources nominated to the National Register of Historic Places	Opportunity	At least 5 per	planning	period
Number of Passport in Time (PIT) or other education projects that provide opportunities for the public to learn about the past and cultural resources	Opportunity		1 per year	
Minimum amount of non-project cultural inventory completed	Opportunity	100 acres	per planning	period

Indicator	Alt. A[a]	Alt. B	Alt. C	Alt. D
Minimum number of MOUs renewed or established with culturally affiliated tribes	Opportunity	5 per planning period		
Average number of Christmas tree permits provided	5,000 per year			
Minimum number of instream flow water rights applications prepared	Opportunity	One per year		

[a] Alternative A, the no action alternative, has a different set of management areas than the action alternatives; a crosswalk, found in appendix D, was used so that the alternatives could be compared.

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter summarizes the physical, biological, social, and economic environments of the planning area and the environmental consequences to those environments that may occur by implementing each alternative. It also presents the scientific and analytical basis for the comparison of alternatives presented in chapter 2. More detailed information, including methodology and assumptions, can be found in the specific resource specialist report located in the "Plan Set of Documents" and available upon request.

Programmatic Framework of the Land Management Plan

The proposed plan and its alternatives do not authorize implementation of management activities described in the effects analyses. The proposed plan and its alternatives each provide a programmatic framework that guide site-specific actions, but they do not authorize, fund, or carry out any project or activity.

Because the proposed plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. However, there may be implications or longer term environmental consequences of managing the forests under this programmatic framework. The proposed plan sets the stage for what future management actions are needed to achieve desired outcomes (desired conditions, objectives, special areas) and provides the sideboards (suitability, standards, guidelines) under which future activities may occur in order to manage risks to ecological, social, and economic environments. To actually implement site-specific projects, project- and activity-level planning, environmental analysis, and decisions must occur. For example, the proposed plan may contain direction to close or rehabilitate roads to benefit riparian areas; however, a subsequent site-specific analysis and decision must be made for proposals that involve road closures or decommissioning.

Environmental Analyses and Overall Assumptions

In development of the environmental analyses that follow, the best available science was considered and is documented in the "Plan Set of Documents." The environmental analyses focus on the need for change and issues identified through the scoping process.

Several overall assumptions were made in the analyses of alternatives. They include the following:

- The land management plan provides a programmatic framework for future site-specific actions. The actual site-specific location, design, and extent of these actions are not known at this time and would be developed through future project-level analysis.
- Land management plans may have implications, or environmental consequences, of managing the forests under a programmatic framework.
- The potential environmental consequences are only estimates. These environmental analyses are useful in comparing and evaluating alternatives on a forestwide basis but are not to be applied to specific locations on the forests.

- The plan decisions (i.e., desired conditions, objectives, standards, guidelines, special areas, suitability, monitoring) would be followed when planning or implementing site-specific projects and activities.
- Laws, regulations, policies, and applicable best management practices (BMPs) would be followed when planning or implementing site-specific projects and activities.
- Monitoring would occur and management practices would adapt to new information (see the "Adaptive Management" section below).
- The Apache-Sitgreaves NFs would be funded in future years at levels similar to the past 5 years.
- The planning timeframe (planning period) is 15 years; other timeframes may be analyzed depending on the resource.
- Resource management activities proposed by alternative would occur to the extent necessary to achieve objectives and maintain, move toward, or achieve desired conditions.
- Plan objectives are generally stated as a range (from low to high). The actual level of accomplishment would depend on environmental conditions, budgets, and staffing.
- As movement toward or achievement of desired conditions is made, forest ecosystems would become healthier and more resilient and would continue to provide for species diversity, goods, and services.

Terminology

Varied terminology is used throughout this document to represent key concepts in these analyses, including the following:

Ecological restoration is the process of assisting a degraded, damaged, or destroyed ecosystem in the recovery of its resilience and adaptive capacity. Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions. In the Southwestern Region, achievement of desired conditions means that the ecosystem has been restored. Restoration treatments are those that move ecosystem components toward desired conditions. This concept is also referred to as **restoration** or **maintenance and/or improvement of ecosystems**.

Potential natural vegetation type (PNVT) is the vegetation that would occur in the presence of natural disturbance processes such as frequent fire return intervals.

Reference conditions are environmental conditions that infer ecological sustainability. Reference conditions are often represented by the historic range of variation (i.e., the characteristic range of variation, not the total range of variation) for a particular attribute, prior to European settlement and under the current climatic period. For some ecosystems, the historic range of variation reflects native burning prior to settlement.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR § 1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare; create and maintain conditions under which man and nature can exist in productive harmony; and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101). Short-term uses are those that generally occur for a finite time period. Long-term productivity refers to the ability of the land to produce a continuous supply of a resource.

The change in the programmatic management of the Apache-Sitgreaves NFs under any of the action alternatives would not provide for any short-term uses that would jeopardize the long-term productivity of the lands and resources of the forests because productivity is addressed at the project-level. Descriptions of short-term and long-term environmental consequences can be found in the “Environmental Consequences of Each Alternative by Resource” section of this chapter.

Unavoidable Adverse Environmental Consequences

The proposed plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Therefore, decisions made in the proposed plan do not cause unavoidable adverse environmental consequences. The application of standards and guidelines during future project and activity decisionmaking would provide resource protection measures and would limit the extent and duration of any adverse environmental impacts. For a detailed discussion of types of environmental consequences expected from future activities, see specific resource topic areas in this chapter.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those lost for a period but could be regained, such as the temporary loss of timber productivity in forested areas kept clear for use as a power line right-of-way or road.

Because the proposed plan does not directly authorize or mandate any site-specific project or activity (including ground-disturbing actions), none of the alternatives causes an irreversible or irretrievable commitment of resources. Future project-level decisions under any alternative may result in potential irreversible or irretrievable commitments of resources, which would be disclosed accordingly.

Adaptive Management

All alternatives assume the use of adaptive management principles. Forest Service decisions are made as part of an ongoing process, including planning, project implementation, and monitoring and evaluation. The proposed plan identifies a monitoring strategy. Monitoring the results of actions would provide a flow of information that may indicate the need to change a course of action or the plan. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information. The forest supervisor will continue to evaluate the plan monitoring results to determine if any changes are needed in management actions or the plan itself. In general, biennial evaluations of the monitoring information consider the following questions on a forestwide basis:

- What are the effects of resource management activities on the productivity of the land?
- To what degree are resource management activities maintaining or making progress toward the desired conditions and objectives set by the plan?

- What changes are needed to account for unanticipated changes in conditions?

As a result of biennial monitoring and evaluation or other information, the forest supervisor may amend the plan or complete an administrative correction at any time. The land management plan is ordinarily revised on a 10- to 15-year cycle.

Climate Change

Most climate scientists agree that the earth is undergoing a warming trend and that human-caused increases in atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases (GHGs) are among the causes of global temperature increases. The observed concentrations of these greenhouse gases are projected to increase. Climate change may intensify the risk of ecosystem change for terrestrial and aquatic systems, affecting ecosystem structure, function, and productivity.

Appendix A of the proposed plan identifies the potential climate change trends and impacts to management of the Apache-Sitgreaves NFs. For applicable resources, the possible environmental consequences associated with climate change are discussed in this chapter.

Environmental Consequences of Each Alternative by Resource

All relevant resources were analyzed for anticipated environmental consequences from implementing each alternative. Unless noted, the effects of the 2011 Wallow Fire are incorporated into the affected environment descriptions. Specialist reports containing further documentation of the analyses and resulting consequences can be found in the “Plan Set of Documents” located at the Apache-Sitgreaves NFs Supervisor’s Office in Springerville, Arizona.

Air

This qualitative analysis describes general trends and projected conditions in relation to the National Ambient Air Quality Standards (NAAQS) and Regional Haze Rule (EPA, 1999) as described in the State Implementation Plan (ADEQ, 2011). Any differences in projected conditions due to proposed forest activities are described in this section. Environmental consequences to air quality related to smoke are described in the “Fire” section. The full analysis for air quality can be found in the “Air Quality Specialist Report” (Forest Service, 2014a) available in the “Plan Set of Documents.”

There are six pollutants identified by the Environmental Protection Agency (EPA) that were reviewed in relation to sources within and outside the Apache-Sitgreaves NFs (EPA, 1990):

- **Carbon monoxide** (CO) is a colorless, tasteless, odorless gas produced primarily by motor vehicles. Other sources include wood burning stoves, fireplaces, wildfires, and industries that process metals or manufacture chemicals. High CO concentrations can occur in large urban areas and settle in mountain valleys. CO is poisonous at high levels and can damage the heart and central nervous system.
- **Lead** in the air exists primarily as particulates. The major source used to be gasoline, but currently is metals processing. Other sources are waste incinerators, utilities, and lead-acid battery manufacturers. Lead particularly affects young children and infants and is

found at high levels in urban and industrial areas. Lead deposits on soil and water and can harm animals.

- **Nitrogen Dioxide** (NO_2) has a reddish-orange-brown color and a pungent odor. Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. The primary sources are motor vehicles, electric utilities, and other industrial, commercial, and residential operations that burn fuels. Some NO_2 is emitted by wildfires through combustion of forest fuels. Once in the atmosphere, NO_2 is easily converted to nitrates, a major component of acid rain, contributing to impacts to vegetation, visibility, and soil and water quality. Nitrogen dioxide also impairs human health.
- **Ozone** is an unstable gas and has a characteristic odor. Ozone forms when hydrocarbons and nitrogen oxides chemically react in sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapors, chemical solvents, and natural sources emit compounds that form ozone. Ozone can trigger a variety of health problems including permanent lung damage after long-term exposure. It can also damage plants and ecosystems.
- **Particulate Matter** (PM) consists of particles of solid or semisolid materials in the atmosphere. Most human-made particles are 0.1 to 10 micrometers in diameter. Particulates less than or equal to 10 micrometers (PM_{10}) can cause respiratory problems; while larger particulates settle out of the air. Airborne dust, or particle pollution, causes significant problems with human health and the environment. Particulates less than or equal to 2.5 micrometers ($PM_{2.5}$) are generally created during combustion and are the major cause of visibility impairment. These fine particles can be moved over long distances by wind and settle on ground or water. High PM concentrations are often associated with large urban areas or mountain valleys where dust, smoke, and emissions are common. Health effects of PM include respiratory problems, decreased lung function, asthma, chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and premature death in people with heart or lung disease.
- **Sulfur dioxide** (SO_2) is a colorless gas that easily dissolves in water to form acid. It is a major pollutant throughout the world and potentially carcinogenic. The main source is burning fossil fuels, but diesel fuel and gasoline also contribute to SO_2 in the air.

A portion of the forests falls within Arizona's sulfur dioxide (SO_2) maintenance plan (ADEQ, 2002) area near Morenci, AZ. Disturbances (e.g., vehicles traveling on unpaved roads, smoke from fires) may have an insignificant impact on air quality within this nonattainment area. Since the Morenci copper smelter was closed, measured values of SO_2have been well below those stipulated in the maintenance plan (ADEQ, 2002).

In addition, Section 169A of the Clean Air Act (CAA) sets forth a national goal to prevent any future (and the remedying of any existing) impairment of visibility in Class I areas from human-caused emissions. The Regional Haze Rule, 40 CFR § 51, calls for states to establish goals and emissions reduction strategies for improving visibility in all mandatory Class I national parks and wilderness areas. The national visibility goal for each Class I area is to return to natural visibility conditions by 2064. A Class I airshed on the Apache-Sitgreaves NFs is located above Mount Baldy Wilderness; attainment of air quality standards for visibility are measured at this site.

For this analysis, air pollutants were separated into two categories: pollutants from sources outside the Apache-Sitgreaves NFs and pollutants from sources within the Apache-Sitgreaves NFs. The impacts of these sources were analyzed based on whether the emissions would cause the Mount Baldy Class I airshed to be in nonattainment.

Sources contributing some of the six pollutants from outside the Apache-Sitgreaves NFs are nearby coal-fired power plant emissions, motor vehicle emissions, and regional haze contributors (particulate matter emissions) including road dust and smoke from nearby prescribed fires and road use. Sources contributing some of these six pollutants from within the Apache-Sitgreaves NFs are motor vehicle emissions and regional haze contributors including road dust and smoke from prescribed fires.

In the analysis for this resource, assumptions include the following:

- Outside sources of air pollutants would either stay constant or would improve (i.e., fewer emissions) during the planning period.
- Proposed forest restoration activities would occur to the extent necessary to achieve the desired conditions and objectives of each alternative and would adhere to air quality standards as set forth by Arizona Department of Environmental Quality (ADEQ).

Affected Environment

Existing Impacts of Air Pollution on the Apache-Sitgreaves NFs from Outside Sources

Emissions of air pollutants from outside the Apache-Sitgreaves NFs come from nearby coal-fired power plants, motor vehicles, and regional haze. The air quality, as measured at the Mount Baldy Class I airshed, is currently in attainment and expected to stay in attainment or improve (ADEQ, 2011).

Coal-Fired Power Plants

Coal-fired power plants are located in the vicinity of the planning area. The Springerville Generating Station is about 14 miles away from the forests and about 31 miles from Mount Baldy Wilderness. The Coronado Generating Station is about 30 miles from the forests and about 45 miles from Mount Baldy Wilderness. The Cholla Generating Station is about 30 miles from the forests and 80 miles from Mount Baldy Wilderness. They produce air pollution emissions recognized as contributors to degraded air quality impacting the planning area. Air pollution, in the forms of gases and aerosols, reaches ecosystems on the ground through atmospheric deposition. Pollutants deposited include oxides of nitrogen and sulfur, ozone, and particulates. These compounds can impair terrestrial and aquatic ecosystems, impair visibility, and impact human health. Specific concerns include maintaining air quality sufficient to comply with National Ambient Air Quality Standards (NAAQS), as well as those related to degradation of visibility and increased deposition. While impacts of air pollution on visibility have been well documented, in many cases, the inventorying, monitoring, and research necessary to document air pollution effects on NFS ecosystems are insufficient.

Several components of air pollution can affect vegetation, but ozone generally results in the greatest amount of damage. Visible effects on leaves or needles can include stipple (dark colored lesions resulting from pigmentation of injured cells), fleck (tiny light-colored lesions on the upper layers of the leaf), mottle (degeneration of the chlorophyll that cause a blotchy appearance), necrosis (death of tissue), and in extreme cases, mortality. Ozone exposure can also decrease plant growth rates. Ponderosa pine is recognized as an ozone-sensitive species.

Acidity in rain, snow, fog, and dry deposition can affect soil fertility and nutrient cycling and can result in acidification of lakes and streams. Sulfate deposition to sensitive watersheds results in increasing soil acidification and surface water acidification. Deposition of excess nitrogen (nitrate and ammonium) in both terrestrial and aquatic systems can acidify streams, lakes, and soils. Aquatic ecosystems in Arizona are generally well buffered and not subject to episodic or chronic acidification except at the highest elevations in and around Mount Baldy Wilderness (Blankenship, 1991).

Motor Vehicles

Tailpipe emissions from motor vehicles contributing air pollutants are considered negligible in relation to the Class I airshed at Mount Baldy. Dilution and air mixing reduces impacts within a short distance. Although vehicle pollution can pose a problem in confined areas, such as a city, the number of vehicles contributing emissions within the Mount Baldy Class I airshed is not deemed measurable. In addition, the majority of motor vehicles are approved to meet EPA emission standards, which reduce off-forest impacts further.

Regional Haze

Regional haze is a contributor to visibility impairment and has been documented in all Class I airsheds in Arizona and New Mexico. In the Intermountain West, sulfate, organics, and elemental carbon are the main cause of visibility impairment. Sources of regional haze contributing to the Mount Baldy Class I airshed are dust and smoke in the form of particulate matter (PM).

In the 1990 amendments to the Clean Air Act, Congress established the requirements to address regional haze. They gave EPA the authority to establish visibility transport commissions and promulgated regulations to address regional haze. The 1990 amendments also established a visibility transport commission (Grand Canyon Visibility Transport Commission or GCVTC) to investigate and report on regional haze visibility impairment in Grand Canyon National Park and nearby Class I areas (including Mount Baldy). The assessment (GCVTC, 1996) indicated that road dust is a large contributor to visibility impairment on the Colorado Plateau which includes the northern half of Arizona. Road dust is generated on the forests as well as off the forests on private, State, and tribal lands. Most of the roads on the Colorado Plateau are not paved and contribute to visibility impairment.

Smoke is also a contributor to regional haze. The State has developed statutes for the management of smoke within each smoke management zone (airshed) and regulates smoke from prescribed fires. Smoke management zones include multiple jurisdictions and landowners. This coordination results in mitigation of the cumulative effects of smoke from burning activities (see the “Fire” section).

Existing Impacts of Air Pollution from within the Apache-Sitgreaves NFs

Apache-Sitgreaves NFs management activities do not appreciably contribute to the six pollutants identified by the EPA, except for particulate matter. The primary source of particulate matter from the forests comes from road and fugitive dust and emissions from smoke, contributing to regional haze. Motor vehicle use on the forests also contributes vehicle emissions.

Motor Vehicles

Motor vehicle emissions from within the Apache-Sitgreaves NFs are deemed negligible in relation to the Mount Baldy Class I airshed. The number of vehicles operating across the forests is not considered to measurably impact air quality. Additionally, Mount Baldy is located upwind of all roads on the forests and has few nearby roads which receive little traffic. In addition, the majority of motor vehicles are approved to meet EPA emission standards, which reduce forest impacts further.

Regional Haze

The Apache-Sitgreaves NFs do not currently fall within nonattainment areas for any of the listed pollutants (EPA, 2006). According to Arizona regulations, this eliminates the need to do complex modeling or projections for minor projects and activities that do not have regional significance[13]. Prescribed fire does have regional significance; therefore, modeling and projections are conducted for all prescribed fire projects. Counties and municipalities may invoke additional requirements for projects or activities that are a source of pollutants; however, none have been identified in lands associated with the Apache-Sitgreaves NFs.

Dust generated from vehicles driving on unpaved NFS roads can contribute to regional haze. There is no direct relationship between miles of roads on the forests and actual miles traveled by motor vehicles. This is more a function of peak usage times such as during summer holidays when the forests get high use. During winter, the same roads generate almost no usage by vehicles. Additionally, dust generated from unpaved roads generally settles out within a short distance (around 20 feet) of the point of generation. Larger particle sizes of road dust drop out within tens of feet, while smaller particles drop out within a quarter mile. Unless winds carry road dust a farther distance, dust generated on the forests does not leave the forests.

Environmental Consequences of Alternatives

Impacts of Air Pollution on the Apache-Sitgreaves NFs from Outside Sources

In relation to sources of air pollution from outside the Apache-Sitgreaves NFs, emissions from coal-fired power plants would likely remain the same or decrease in **all alternatives**, as would emissions from motor vehicles. Some contributors to regional haze related to wildfire, road, and windblown dust would increase. The State's source emission projections describe decreases in sulfur dioxide, nitrogen oxides, elemental carbon, and volatile organic compounds. Increases are projected in organic carbon, ammonia, and fine and coarse particles (ADEQ, 2011). These haze pollutants are monitored near Mount Baldy by the Interagency Monitoring of Protected Visual Environments (IMPROVE) (Colorado State University, 2006) program.

None of Arizona's Class I areas, including Mount Baldy, are projected to meet the Uniform Rate of Progress (URP) for 2018; however, most would be below baseline conditions (table 5). Many

[13] The State Implementation Plan (40 CFR § 51.309(d)(7)) (ADEQ, 2003) for Arizona from December 23, 2003, states "road dust is not a measurable contributor on a regional level to visibility impairment in the 16 Class I areas. Due to this finding, no additional road dust control strategies are needed…"

of the air pollutants that affect Arizona originate from sources outside Arizona, such as Mexico and surrounding states, and are due to natural conditions. The State has a list of strategies (long-term strategy or LTS) to address regional haze visibility impairment in each Class I area in Arizona. For further information on the LTS, refer to the 2011 State Implementation Plan at http://www.azdeq.gov/environ/air/plan/notmeet.html.

Table 5. Summary of 2018 projected visibility conditions[a]

Class I Area	20% Worst Days Visibility (dv[b])			20% Best Days Visibility (dv)		
	Worst Day Baseline (2004)	2018 URP[c] Goal	2018 Projected Visibility	Best Days Baseline (2004)	2018 Projected Visibility	2018 Projected less than Baseline
Mount Baldy Wilderness	11.85	10.54	11.52	2.98	2.12	Yes

[a]Information from ADEQ 2011 State Implementation Plan (p. 81).

[b]A deciview is the change in the haze index which is derived using a complex calculation from measured particulate concentrations data. One deciview is considered a humanly perceptible change under ideal conditions, regardless of background visibility conditions (ADEQ, 2011).

[c]The uniform rate of progress (URP) is the calculation of the slope of the line between baseline visibility conditions and the natural visibility condition over the 60-year period to 2064. For the first regional haze plan, the first benchmark is the deciview (dv) level that should be achieved in 2018 (ADEQ, 2011).

Impacts of Air Pollution from within the Apache-Sitgreaves NFs

There would be continued use of forest roads by motor vehicles, which is expected to increase over the next 15 years. Under **all alternatives**, the environmental consequences from motor vehicle emissions would be slightly higher than described in the affected environment due to increased forest use; however, emissions would not be expected to measurably impact air quality. The Class I airshed above Mount Baldy would continue to be in attainment of air quality standards and would continue to meet NAAQ standards as set by EPA.

Figure 6. Aerial view of Mount Baldy Wilderness

Use of motor vehicles on unpaved roads would also increase over the existing condition. This would result in the generation of dust, which is not expected to cause impairment in visibility and would not cause a measurable impact to the Class I airshed at Mount Baldy. Any proposed forest management activities that would contribute dust would adhere to air quality standards as set by EPA and ADEQ and the effects would be mitigated at the project-level.

Dust Generated from Mechanical Treatments

The soils of the forests' undisturbed ecosystems resist wind through plant or litter cover, as well as naturally occurring crusts known as macrobiotic soil crusts. Soil crusts are fragile; however, they resist wind and help prevent dust particles from becoming airborne. When the crust is broken through mechanical activities or disturbance such as grazing, small particles can get into the air during the activity or later during high wind events. Under **all alternatives**, all land disturbing activities, including wildland fire, would include site-specific best management practices (BMPs) or soil and water conservation practices (SWCPs) (Forest Service Handbook 2509.23 R3) that prescribe measures to reduce or mitigate formation of fugitive dust either by preventing loss of protective ground cover or by requiring reestablishment of ground cover.

Dust generated from mechanical treatments would potentially be greatest under **alternative C**, which proposes the highest amount of mechanical treatment and associated road use. It would be less in **alternative B,** then **alternative A,** and least in **alternative D** where wildland fire treatment acres are much higher than mechanical treatment acres.

Road dust and dust generated from motorized equipment would be largely dependent upon the season of use, the amount of traffic, rainfall patterns, and materials selected for road construction. This dust generally settles quickly, but can become fugitive dust where conditions are typically dry and/or where roads are constructed from fine-grained materials and do not have a paved or gravel surface. Dust mitigation (e.g., road watering, surfacing, chemical treatment) may occur in high traffic areas to improve road visibility and where activities are close to private land or large campgrounds to prevent impacts to human health.

Dust Generated from Recreation Activities

Recreation use of the transportation system can vary in intensity during late spring/early summer and late fall months, when dust can be problematic. Recreation use can occur on any open road. One of the most popular recreation uses on the forests is driving for pleasure (Kocis et al., 2002). Dust abatement measures may not be applied on most system roads due to budget limitations, and may not occur on non-NFS roads. Dust generated from recreation activities may increase in the long term as the general population increases in **all alternatives**. However, **alternative C** emphasizes motorized recreation opportunities more than the other alternatives; consequently, it would result in the highest level of dust generated from recreation activities.

Dust Generated from Grazing Activities

Under **all alternatives,** grazing management use of the transportation system is limited and effects to air quality from this activity would not be measurable. Fugitive dust may be generated in areas with the highest livestock concentration or from vehicles accessing allotments to conduct livestock management. There is no measurable difference expected between alternatives as related to dust generated from livestock grazing activities. BMPs should be effective in retaining protective ground cover, reducing exposed soil susceptible to wind erosion, and creation of dust.

Dust Generated from Special Uses

Under **all alternatives**, road use associated with mineral materials or energy development may require dust abatement measures. Implementation of dust abatement measures would reduce or eliminate impacts to air quality. There are no formal applications currently known. Effects of dust would be analyzed prior to issuance of each special use permit.

Climate Change

Based on current climate models, the climate change factors that may influence smoke and dust are projected increases in wildfire risk and national forest socioeconomic uses and demands. These indicate the need to improve forest health to reduce wildfire risk, as well as preparing for increased use of forest materials and greater demand for recreation. **All alternatives** include desired conditions to manage for healthy, resilient forests, reduce uncharacteristic wildfire, and provide wood products and recreation opportunities.

Cumulative Environmental Consequences

The cumulative environmental consequences are spatially bounded by an area much larger than the Apache-Sitgreaves NFs. Some effects are limited to local airsheds which generally follow watershed boundaries. Others, such as those affecting visibility, can be generated as far away as Mexico or California. Long-range transport of pollutants was analyzed and displayed in the 2011 SIP (ADEQ, 2011).

Pollutants generated from off-forest activities that affect the forests' visibility at the local watershed level include road dust, prescribed fires, and emissions from industrial sources. Road dust is generated off-forest on private, State, and tribal lands in addition to dust generated on-forest. Most of the roads on the Colorado Plateau are not paved. Vehicle use off-forest combined with vehicle use on-forest would occur in **all alternatives** and could contribute to visibility impairment.

Prescribed fires on other lands within the same airshed may affect the ability of the forests to use prescribed fire under **all alternatives** due to the cumulative environmental consequences of smoke. Wildfires are exempt from this rule, but may also affect the ability of the forests to use prescribed fire due to the cumulative environmental consequences of smoke. Smoke is also a contributor to regional haze.

In addition, coal-fired generating plants would continue to contribute pollutants known to degrade air quality as described in the affected environment. Emissions are closely monitored and generating plants are regulated by the State as meeting best available control technology when new units are constructed or old units are refurbished. Emissions, such as sulfur dioxide and nitrogen oxides, are expected to be reduced in the future (ADEQ, 2011).

Soil

This section analyzes the soil resource by describing the current soil condition and projected trends in soil condition by alternative. It also describes the potential effects to soil conditions associated with management activities. The alternatives are compared using the average treatment level.

The forests use soil condition as a descriptive indicator of general soil health. Soil condition is based on the primary soil functions of soil hydrology, soil stability, and nutrient cycling. The current soil condition rating is described in the "Ecological Sustainability Report" (Forest

Service, 2008e) and is based on how departed soils are from the reference condition. The projected trends in soil condition are based on estimates of vegetative ground cover, soil productivity, and organic matter. The full analysis for soil resources can be found in the "Soils Specialist Report" (Forest Service, 2014s) available in the "Plan Set of Documents."

The 2011 Wallow Fire had dramatic effects on soil conditions, including an estimated 28 percent increase in impaired and unsatisfactory conditions. Details can be found in the "Soils Specialist Report" (Forest Service, 2014s). Estimated time for recovery to satisfactory conditions within the burned area depends on many factors including pre-burn conditions, burn severity, post-fire treatments, management, and weather patterns. As a result, soil condition would not be inventoried until more of the fire area has stabilized. Within 5 years and where soils are capable, ground cover is expected to increase enough in high and moderate burn severity areas to bring erosion rates to a level where long-term soil productivity is no longer at risk (Forest Service, 2008e; Forest Service, 2010j; Elliot, 2001). Many areas treated with mulch and seeding have already stabilized. The forestwide soil condition trend estimates described in table 7 do not reflect changed conditions from the 2011 Wallow Fire.

Affected Environment

Soils of the Apache-Sitgreaves NFs

Soils are a physical element of the environment made up of mineral particles (sand, silt, and clay), air, water, and organic matter. Soils form by the interaction between climate, organisms, topography, parent material, and time. Soils store water, supply nutrients for plants, and provide a medium for plant growth. Soils also provide habitat for a diverse number of belowground organisms. Due to their slow rate of formation, soils are essentially a nonrenewable resource.

The forests soils are described in the "Terrestrial Ecosystem Survey of the Apache-Sitgreaves NFs" (TES) (Laing et al., 1987). The TES is the result of the systematic analysis, mapping, classification, and interpretation of terrestrial ecosystems, also known as ecological types, delineated in ecological units. It stems from decades of work and is the only complete mapping of vegetation and soils available across the forests that include field validated and correlated sites meeting regional and national protocol. The TES was developed using local, regional, and southwestern U.S. research data collected prior to its publication in 1987. The forests use ground cover and vegetation canopy cover provided for each mapping unit to establish resource value ratings for soil and plant health for many management activities, particularly in the analysis and monitoring of restoration treatments and for grazing allotment management. The TES will be updated as new information is available and will occur within the planning period.

Soils of the Apache-Sitgreaves NFs developed primarily from sedimentary and volcanic origins. Soils range from very shallow to deep and old and well developed to recent and less developed. They occur on all slope ranges from nearly level to very steep.

Soil Condition

Soil condition is a descriptive indicator of general soil health. Soil condition is primarily determined by evaluating surface soil properties. This is the critical area where plant and animal organic matter accumulate, begin to decompose, and eventually become incorporated into soil. It is also the zone of maximum biological activity and nutrient release. The physical condition of this zone plays a significant role in soil stability, nutrient cycling, water infiltration, and energy flows. The presence and distribution of the surface soil is critically important to productivity.

Soil condition is based on an interpretation of factors which affect three primary soil functions: soil hydrology, soil stability, and nutrient cycling, all of which are interrelated. Soil condition is categorized by four classes: satisfactory, impaired, unsatisfactory, and inherently unstable. The following definitions describe each class:

- **Satisfactory**: Indicators signify that soil function is being sustained and soil is functioning properly and normally. The ability of the soil to maintain resource values and sustain outputs is high.
- **Impaired**: Indicators signify a reduction in soil function. The ability of the soil to function properly and normally has been reduced and/or there exists an increased vulnerability to degradation. An impaired category indicates there is a need to investigate the ecosystem to determine the cause and degree of decline in soil functions. Changes in land management practices or other preventative measures may be appropriate.
- **Unsatisfactory**: Indicators signify that a loss of soil function has occurred. Degradation of vital soil functions results in the inability of the soil to maintain resource values, sustain outputs, or recover from impacts. Unsatisfactory soils are candidates for improved management practices or restoration designed to recover soil functions.
- **Inherently Unstable**: These soils have natural erosion exceeding tolerable limits and are eroding faster than they are renewing themselves, but they are functioning properly and normally.

Current soil condition was developed for the forests during this analysis, using TES ecological map units as a basis. It is summarized by PNVT to help describe conditions where past management activities and proposed treatments may be similar. Table 6 displays the percent of each current soil condition class (with the desired soil condition class percentage in parentheses) for each PNVT.

Approximately half the PNVTs have a majority of satisfactory soil conditions (6 of 14 PNVTs). Impaired soils are dominant on most of the remaining types (5 of 14 PNVTs). Three PNVTs have large extents of unsatisfactory or inherently unstable soil conditions: Madrean pine-oak woodland, interior chaparral, and semi-desert grassland. PNVTs with satisfactory soil condition have natural overstory canopy cover levels to allow for the desired amount of plant and litter ground cover. They have unaltered or natural levels of soil hydrologic function, such as high infiltration rates, high capacity for soil moisture storage, strong structure, and soil pores to aid transmission of water deeper into the soil profile. They are stable and readily cycle nutrients for improved plant growth.

Woodland and grassland PNVTs with soil condition less than satisfactory tend to have unnaturally dense overstory canopy cover levels, reduced levels of vegetative ground cover, poor distribution of vegetative ground cover (plant basal area and litter), and reduced soil hydrologic function. They are generally not stable and may have reduced levels of nutrient availability. They also can be in areas where uncharacteristic wildfire has altered canopy and ground cover levels, altered infiltration rates, and high levels of soil erosion.

Table 6. Current and desired soil condition[a] class as a percent of each PNVT; ( ) indicates desired condition

PNVT	Satisfactory	Impaired	Unsatisfactory	Inherently Unstable
Ponderosa Pine Forest	94% (95–100%)	0% (0–5%)	6% (0%)	0% (0%)
Dry Mixed Conifer Forest	87% (95–100%)	0% (0–5%)	13% (0%)	0% (0%)
Wet Mixed Conifer Forest	100% (95–100%)	0% (0–5%)	0% (0%)	0% (0%)
Spruce-Fir Forest	100% (95–100%)	0% (0–5%)	0% (0%)	0% (0%)
Madrean Pine-Oak Woodland	4% (37–42%)	9% (0–5%)	29% (0%)	58% (58%)
Piñon-Juniper Woodland	16% (85–90%)	74% (0–5%)	0% (0%)	10% (10%)
Interior Chaparral	0% (14–19%)	0% (0–5%)	19% (0%)	81% (81%)
Great Basin Grassland	5% (95–100%)	92% (0–5%)	3% (0%)	0% (0%)
Semi-desert Grassland	7% (42–47%)	26% (0–5%)	15% (0%)	53% (53%)
Montane/Subalpine Grasslands	92% (95–100%)	8% (0–5%)	0% (0%)	0% (0%)
Cottonwood-Willow Riparian Forest	25% (85–90%)	57% (0–5%)	8% (0%)	10% (10%)
Mixed Broadleaf Deciduous Riparian Forest	28% (95–100%)	64% (0–5%)	8% (0%)	10% (10%)
Montane Willow Riparian Forest	28% (95–100%)	68% (0–5%)	4% (0%)	0% (0%)
Wetland/Cienega Riparian Areas	100% (95–100%)	0% (0–5%)	0% (0%)	0% (0%)

[a] Condition is a pre-Wallow Fire estimate.

Soil Crusts

An important component that affects soil condition is the condition of soil crusts. Macrobiotic crusts are the community of organisms living at the surface of soils. Major components are cyanobacteria, green algae, microfungi, mosses, liverworts, and lichens. Biological soil crusts are commonly found in semiarid and arid environments and have been observed in coarse-textured soils predominantly in piñon-juniper woodlands, semi-desert grasslands, and desert communities on the forests, and to a limited extent, in other vegetation dryer than piñon-juniper woodlands. Of most importance is the role crusts play in maintaining productivity of the semi-desert and Great Basin grassland and woodland ecosystems. Mosses and other crust-forming organisms are found in wetter environments but are less important to overall soil productivity.

Crusts are well adapted to severe growing conditions but poorly adapted to compressional disturbances. Domestic livestock and elk grazing and recreation activities (e.g., hiking and biking cross-country, motorized cross-country travel) place a heavy toll on the integrity of the crusts. Disruption of the crusts decreases organism diversity, soil nutrients, stability (and increased soil loss), organic matter, and soil productivity. Studies of trampling disturbance have noted that losses of moss cover, lichen cover, and cyanobacterial presence can be severe (10 percent, 33 percent, and 50 percent, respectively), runoff can increase by half, and the rate of soil loss can increase six times without apparent damage to vegetation. Ungulate grazing where crusts are present poses an unquantifiable risk to soil productivity and ecosystem diversity and those species that depend on soil crust habitat for their survival (Johnston, 1997).

According to Belnap et al. (2001), biological crusts are generally killed by hot ground fires, resulting in loss of biomass and visible cover (Johansen et al., 1993). Frequent burning prevents recovery of lichens and mosses, leaving only a few species of cyanobacteria (Whisenant, 1990). Damage and recovery of biological crusts depends on pre-fire conditions, as well as characteristics of the fire. Historic burning left small patches of unburned areas between bunchgrasses, or at larger scales, it left patches of unburned shrubs across the landscape. This left a mosaic of successional stages and provided regeneration material for fire damaged areas (Whisenant, 1990; Peters and Bunting, 1994).

In most areas where crusts have been observed, they currently cover less than 5 percent of the soil surface. There are areas within the 2002 Rodeo-Chediski Fire within the ponderosa pine and piñon-juniper PNVTs that have developed macrobiotic crusts (up to 10 percent ground cover).

Past Management Impacts on Soil Condition

Before European settlement, soil loss, soil compaction, and nutrient cycling would likely have been within functional limits to sustain soil function and maintain soil productivity for most soils. The exception to this could be relatively short-term effects of wildfire during times of drought. Soil condition would have been similar on similar soils throughout the range of the PNVTs both within and outside of the forests.

Much of the current soil condition is related to past management on the forests. Soil condition is impacted by activities that occur or recur at the same place over time. Permanent loss of soil productivity affects the future level of forest products and beneficial uses of the forests. Management activities that have affected soil condition include timber harvesting, prescribed fires, road construction and use, recreation facilities construction and use, grazing, and special uses. Some examples of impacts that have affected current soil condition on the forests include the following:

- Heavily compacted soils from forest restoration treatments, grazing, and recreation activities have caused or may cause reduced productivity for decades (Burger et al., 1998).
- Land disturbing activities have caused erosion of topsoil at rates greater than the soils natural ability to replace it (commonly referred to as soil loss tolerance rate) and resulted in permanent loss of soil productivity, as soils are considered a nonrenewable resource (Renard et al., 1997).
- From 1902 to 1987, as more livestock numbers and acres were grazed, range condition (and soil condition) declined. As fewer number and acres were grazed, range condition improved.

- According to Gori et al. (2007), livestock and large wildlife grazing removed fine fuels needed to carry surface and mixed-severity fires that likely maintained the more open structure and composition of piñon-juniper savannas and shrub woodlands historically.
- Road corridors that make up the forests' road system resulted in loss of soil productivity.
- Mineral material extraction pits and mines resulted in permanent loss or reduction in soil productivity.
- Uncharacteristic wildfire resulted in erosion rates well beyond tolerance erosion rates.
- Areas within administration and recreation sites have reduced soil productivity.
- Permanent special use sites—such as communication towers and buildings—eliminated soil productivity within the footprint of such structures.

There are activities that have improved soil condition, as well as removed risk to soil productivity:

- Prescribed fire has removed fuels and undesirable plant material which impede vegetation growth and condition.
- Dense forest, woodland, and invaded grassland canopy thinning treatments have reduced light and water competition for desired understory grasses and shrubs.
- Channel restoration projects have restored bank and vertical streambed stability and reestablished groundwater table levels resulting in increased vegetation/soil productivity.
- Closure of maintenance level 1 roads and decommissioning or removal of unneeded roads has resulted in revegetation of old roadbeds.

Environmental Consequences of Alternatives

Soil Condition Trends

Generally, **alternative A** would trend away from desired conditions for soil condition and could result in additional areas with reduced soil function and increased vulnerability to degradation. The **action alternatives** would trend toward desired conditions or would be static in most cases and would have the most areas where soil function is sustained and functioning properly and normally.

Table 7 displays the projected trends in soil condition based on estimates of the soil condition indicators of vegetative ground cover, soil loss, and organic matter, by alternative. Soil conditions were estimated for each PNVT to determine whether conditions would generally trend toward, away, or remain static with the implementation of objectives of each alternative. Desired condition is described as satisfactory condition. Departure is the relative difference between satisfactory and either impaired or unsatisfactory condition. The estimated trends do not take into consideration the effects to soil condition from the Wallow Fire. The effects of the Wallow Fire were not included in this determination as conditions are variable by PNVT within the fire perimeter. The general trend would be that the area is improving at natural recovery rates. Current management within the Wallow Fire burned area ranges from complete avoidance to active management. Plans are not currently in place to determine where future activities would occur.

Table 7. Estimated trends in soil condition during the planning period for each PNVT by alternative

PNVT	Alt. A	Alt. B	Alt. C	Alt. D	Current Departure From DC
Ponderosa Pine Forest	Toward	Toward	Toward	Toward	Slight
Dry Mixed Conifer Forest	Toward	Toward	Toward	Toward	Slight
Wet Mixed Conifer Forest	Static	Static	Static	Static	None
Spruce-Fir Forest	Static	Static	Static	Static	None
Madrean Pine-Oak Woodland	Static	Toward	Toward	Toward	Moderate
Piñon-Juniper Woodland	Toward	Toward	Toward	Toward	High
Interior Chaparral	Static	Static	Static	Static	Slight
Great Basin Grassland	Away	Toward	Away	Toward	Very High
Semi-desert Grassland	Away	Toward	Away	Toward	Moderate
Montane/Subalpine Grasslands	Away	Away	Static	Away	None
Cottonwood-Willow Riparian Forest	Away	Toward	Away	Toward	High
Mixed Broadleaf Deciduous Forest	Away	Static	Away	Static	High
Montane Willow Riparian Forest	Away	Toward	Static	Toward	High
Wetland/Cienega Riparian Areas	Away	Static	Static	Static	None

When PNVTs are closer to their desired conditions, they are more likely to contribute to satisfactory soil conditions. This is because the type and amount of ground cover provides resistance to soil erosion and enhances nutrient cycling and water infiltration by decreasing overland flow rates. A major consideration in predicting ground cover conditions is to compare the current departure of existing vegetative condition and the expected outcomes by alternative (see the “Vegetation” section) to determine whether vegetative conditions are moving toward desired conditions, are static, or are moving away from them.

Soil conditions within riparian areas are tied closely to proper functioning condition (PFC). Riparian areas that are functioning properly have satisfactory soil condition. These soils have adequate vegetation to withstand bank erosion from high flows and trap sediment to form stable floodplains. Functioning-at-risk or not functioning riparian areas generally do not have stable, productive soils. During high flows, ground cover and vegetation are generally not adequate to protect soils; the result is impaired soil condition. Soil condition trends in riparian areas are tied directly to the predicted riparian area trends (see the “Riparian” section).

Soil Crusts

Macrobiotic crusts are affected directly through physical damage and alteration of habitat. Compressional forces compact the soils' hydrologic function, which could provide less water and nutrients to biological crusts. Across **all alternatives**, it is estimated that ongoing, improved cattle management on the forests would benefit biological crusts through decreased trampling as allowable use is aligned with available forage and capacity of the land. In addition, estimated increases in forage would benefit crusts by reducing the pressure from grazing. In **all action alternatives**, because motorized cross-country travel would not be allowed, the elimination of most off-road use would benefit crusts by removing direct damage from compaction and soil displacement by wheeled vehicles. **Alternative A** does not eliminate recreational off-road use.

Wildland fire is used in **all alternatives** and can kill biological crusts and alter soil properties. Individual ground-disturbing projects, including prescribed fire, require site-specific analysis to mitigate effects to biological crusts, especially in the woodland and grassland PNVTs.

Forest Restoration Activities

Mechanical Treatments

Mechanical treatments may impact soil hydrologic function, soil stability, and nutrient cycling through soil compaction and removal of ground cover. **Alternative C** proposes the most mechanical harvest treatments and, thus, the most risk of soil compaction and ground cover removal, followed by a**lternatives B, D, and A**. See table 8 below for average objective levels (acres) of mechanical harvest treatments.

Table 8. Average annual mechanical treatment objectives (acres) for each alternative

Alternative A	Alternative B	Alternative C	Alternative D
12,182[a]	19,591	23,997	15,954

[a] Based on the past 25-year average of vegetation treatments.

The bulk of treatments in **alternative C** would be in the ponderosa pine PNVT on level to moderately steep slopes.

In **all alternatives**, soil compaction, which reduces the soils ability to absorb water and nutrients, could result from timber harvesting operations. The amount of soil compaction is dependent on harvest methods, amount of slash in traffic lanes, operator technique, and soil conditions and properties (Page-Dumroese et al., 2010). Project-level activities would follow BMPs and SWCPs and develop mitigations that would result in minimal soil compaction.

Ground cover may be disturbed during mechanical treatments (including the removal of vegetation) and may, therefore, result in some exposure of mineral soil. Although timber harvesting operations may result in some local soil movement, soil displacement and soil erosion are expected to be minor because most harvest units are designed to have slopes that are not steep (less than 35 percent), with short slope lengths, and adequate ground cover and topsoil would remain intact. BMPs and SWCPs (Forest Service Handbook 2509.22 R3) are effective in mitigating ground disturbance as well as intercepting sediment in runoff. Slash distribution in cut units following timber harvesting may also protect exposed mineral soils from raindrop impacts and erosion.

Wildland Fire Treatments

All alternatives propose the use of wildland fire (both planned and unplanned ignitions) for fuel reduction and ecosystem restoration. Use of prescribed fire allows the manager the opportunity to control the intensity of the fire and to avoid creating high severity burn areas.

Alternative D prescribes the most fire for ecosystem restoration, followed by **alternatives B, C, and then A** (table 9). Fire treatments range from low severity broadcast burning for ground fuel reduction to mixed- or high severity fire (in patches) intended to kill overstory vegetation and reduce canopy cover to a desired level. **Alternatives B and D** propose the most acres of mixed- and high severity fire. These generally may occur in priority watersheds away from urban interface areas. **Alternatives A and C** have the fewest acres of mixed- and high severity fire in forested PNVTs; however, mixed- and high severity fires in woodland PNVTs and grassland PNVTs that are encroached by piñon and juniper species are prescribed. Table 10 describes the environmental consequences to soil condition based on fire severity.

Table 9. Annual wildland fire treatments (acres) and estimated fire severity by alternative

Estimated Fire Severity	Alt. A[a]	Alt. B	Alt. C	Alt. D
Low Severity		3,348	3,066	6,700
Mixed Severity	6,844	23,608	9,082	39,353
High Severity		1,622	707	2,423

[a] Based on the past 25-year average of wildland fire treatments. No breakdown of fire type is available; however, the vast majority (95 percent) is estimated to be low severity. Wildland fire treatments planned in riparian areas not included.

Table 10. Wildland fire characteristics and effects to soil function by fire severity

	Low Severity	Mixed Severity	High Severity
Wildland Fire Characteristics	Prescribed fire reduces fuel loading either for pre- or post- restoration treatment. Removes some ladder fuels. Reduces risk of crown fire.	Some moderate and high severity fire in patches to improve structural diversity and open canopy. Allows for regeneration of shade-intolerant species and restores ecologic condition in most PNVTs.	Some stand replacement, high severity firein small stands to improve structural diversity and open canopy. Allows for regeneration of shade-intolerant species and restores ecologic condition in selected PNVTs.
Effects to Soil Function	Little to no effect to soil functions at all scales.	Soil chemical, physical, and biological function retained in more than 85 percent of the treated area at the fine and mid scales.	Soil chemical, physical, and biological functions may be impacted and require rehabilitation treatments. Soil function retained is more than 85 percent of the treated area at the fine and mid scales.

Wildland fires managed for multiple resource objectives may negatively affect soil's physical, chemical, and biological characteristics. The most important physical characteristic of soil that affects its hydrologic function and stability is soil structure. The organic matter component, which provides for loose, granular structure, can be lost at relatively low temperatures. The loss of soil structure increases the bulk density of the soil and reduces its porosity, thereby reducing soil productivity and making the soil more vulnerable to post-fire runoff and erosion.

Loss of organic matter due to soil heating during wildland fires negatively affects the most basic soil chemical properties (Neary et al., 2005). Soil organic matter plays a key role in nutrient cycling and exchange and water retention in soils. When organic matter is combusted, the stored nutrients are either lost to the atmosphere or are changed into highly available forms that can be taken up readily by microbial organisms and vegetation. The available nutrients not immobilized are easily lost by leaching or surface runoff and erosion. Nitrogen is the most important nutrient affected by fire; it is easily lost from the site at relatively low temperatures. The amount of change in organic matter and nitrogen is directly related to the magnitude of soil heating from fire intensity. High- and moderate-intensity fires cause the greatest losses (severity). Nitrogen loss by volatilization during fires is of particular concern on low-fertility sites because nitrogen can only be replaced by nitrogen-fixing organisms.

Cations (soil nutrients) are not easily volatilized and usually remain on the site in a highly available form. An abundance of cations can be found in the thick ash layers (ashbed) remaining on the soil surface following high severity fires. Soils inherently low in nutrients and thin soils are most impacted by high severity fires, as nutrients are lost. These fragile soils would be identified at the project-level and protection measures would be prescribed.

Soil biology is also affected by wildland fire. How soil microorganisms respond to fire depends on numerous factors, including fire intensity, site characteristics, and pre-burn community composition. Some generalities can be made. First, most studies have shown strong resilience by microbial communities to fire. Recolonization to pre-burn levels is common, with the amount of time required for recovery generally varying in proportion to fire severity. Second, the effect of fire is greatest in the forest floor (litter and duff). Wildland fires that consume major fuels but protect forest floor, humus layers, and soil, are recommended. (Neary et al., 2005)

Motorized Routes

The motorized trail and road system analyzed is the same for **all alternatives**. The motorized route system results in a net loss of soil productivity within the road corridor, including cut and fill slopes. Roads are the dominant source of erosion and sediment in forests (Swank, 1989; MacDonald and Coe, 2008). Some roads are located in areas more sensitive than others, such as along riparian areas or in areas of inherently unstable soils. Removal of roads in riparian areas would eliminate direct deposition of sediment and would allow for channel widening where needed, expansion of plants, and floodplain development. There are a large number of unauthorized routes contributing to loss of soil productivity as well. Table 11 displays objective levels for road removal by alternative.

Table 11. Motorized routes treatment objectives by alternative

Objective	Alt. A	Alt. B	Alt. C	Alt. D
Minimum amount of NFS roads or trails that negatively impact streams or riparian areas to be relocated, repaired, improved, or decommissioned	Opportunity	4 miles/ planning period	Opportunity	4 miles/ planning period
Average amount of unauthorized roads or trails that negatively impact streams or riparian areas to be removed	Opportunity	2 miles/year	3 miles/year	3 miles/year

The motorized route system (miles, management level, and location) is the same for **all alternatives**; however, use of roads, trails, and the additional amount of level 1 roads are estimated to be higher in **alternative C** followed by **alternatives B, D, and then A**, because **alternatives C and B** have the greatest percentages of timber harvest/mechanical restoration treatments of all alternatives. Motorized recreation is also emphasized in **alternative C**.

New road construction is generally not required for timber harvesting within the planning area; however, the reopening of level 1 (those roads placed in storage between intermittent uses) increases the amount of open roads and the amount of soil erosion that occurs during the life of a project. Occasionally, temporary road construction would also remove vegetation along the road corridor, expose mineral soil, and result in soil compaction along the roadbed. Typically, there is a pulse of erosion from roads during the first 2 years following road construction or reopening (MacDonald and Coe, 2008; Megahan, 1974). Slope failures and mass movement of soils may occur as the result of road construction. New roads or reopening closed roads may also provide an avenue for the invasion and establishment of invasive plant species. Temporary roads would be removed and revegetated following use. Road design, avoidance of problem soils, appropriate design criteria, and road closures would be implemented in order to minimize impacts to soils.

Recreation Activities

Recreation use and demand is estimated proportionately for all alternatives with the increase in population. Recreation uses shown to impact soils include camping, hiking, mountain biking, and horseback riding. All of these activities may result in erosion and compaction. Impacts tend to be minor and may occur on only a small percentage of the planning area. Implementing site-specific BMPs and SWCPs for recreation projects would minimize adverse soil impacts. The impacts from recreation could occur under **all alternatives**. No recreation development is specifically outlined in any alternative.

Alternative A would continue to allow motorized cross-country travel. Motorized cross-country travel would increase the potential for sediment delivery to streams, reduce soil productivity due to compaction and erosion, and destroy vegetative cover and natural ground litter. Cross-country motorized travel also could destroy biological soil crusts. The **action alternatives** would eliminate motorized cross-country travel. Erosion and sediment transport would be reduced as disturbed areas revegetate and there would be less physical impact to biological soil crusts.

Grazing Activities

Grazing would continue under **all alternatives**. Livestock and wildlife grazing has the potential to reduce soil condition through hoof compaction and the removal of protective vegetation and, subsequently, ground cover. The effects to soil condition would be reduced soil hydrologic function in highly compacted concentration areas and reduced soil stability from loss of ground cover wherever overutilization of available forage occurs. Grazing cattle would not be considered detrimental where sufficient herbaceous material remains to protect the soils during periods of intense summer rains or during spring runoff. Site-specific BMPs and SWCPs would provide protection from the effects of grazing and are prescribed in project-level analysis.

Differences in soil condition, as related to grazing impacts between alternatives, are indirectly tied to the level of restoration treatments provided for each alternative. Decreased overstory canopy cover, as prescribed in the desired conditions, would potentially increase the understory vegetation, as treatments are implemented and maintained. The relationship between overstory cover and herbaceous production has been studied in Arizona forests (Jameson, 1967; Thill et al., 1983). Increased understory vegetation would indirectly reduce grazing pressure as treatments progress across the forests, because it would increase available forage and allow range managers increased flexibility in management to favor rehabilitation or rest in areas currently not in satisfactory soil condition, such as found in riparian, grassland, and woodland vegetation. Direct impacts to soils from grazing are analyzed at the project-level where effects are mitigated and monitored.

All alternatives would prescribe treatments that improve the vegetation conditions on uplands to more open conditions. By reducing tree canopy, there would be an increase in available forage for grazing animals. This would provide an opportunity for reduced grazing pressure on riparian areas from both domestic and wild animals. **Alternative B, then D** would provide the most opportunity for soil condition improvement or protection because of predicted forage increases in all open canopy PNVTs, as well as direct treatment objectives in riparian areas. **Alternative C** would provide upland improvement in open forested and grassland PNVTs; however, it provides for less forage improvement in woodland or riparian PNVTs. **Alternative A** would provide improvements in soil conditions in open forested and grassland PNVTs. Grazing management plans would provide mitigation to protect sensitive areas from domestic use, including riparian, where often times, grazing exclusion is the only option. Wildlife impacts generally would not be mitigated.

Special Uses

Terms and conditions of special use permits would require site-specific BMPs to provide for maintenance of soil productivity in **all alternatives**. Therefore, there are no anticipated effects to soil condition from permitted special use activities.

Climate Change

Based on current climate models, some of the climate change factors that may influence soil condition include the following:

- More extreme natural ecological disturbance events, including wildfires, intense rains, flash floods, and wind events (Swetnam and Betancourt, 1997).

- Greater vulnerability to invasive species, including insects, plants, fungi, and vertebrates (Joyce et al., 2006).
- Long-term shifts in vegetation patterns (Westerling et al., 2006; Millar et al., 2007).
- Cold-tolerant vegetation moving upslope or disappearing in some areas, migration of some plant species to the more northern portions of their existing range (Clark, 1998).
- Potential decreases in overall forest productivity due to reduced precipitation (Forest Service, 2008e).
- Potential lower vigor and productivity of forage plants and, thus, overall soil conditions.
- Potential decrease in forage production and shortened growing and grazing season.
- Potential flash floods and increased risk of animal disease could adversely affect the livestock industry (Joyce et al., 2001) dependent upon the Apache-Sitgreaves NFs' forage resources.
- Potential decline if adjustments to grazing numbers, based on allowable forage, are not made in response to productivity decreases from climate change.

In light of the changes indicated above, there is a need to reduce vulnerability by maintaining and restoring resilient native ecosystems. Restoring and maintaining resilience in forest, woodland, chaparral, grassland, and riparian ecosystems would be an outcome in **alternatives B, D, C, and A** (in order from greatest resilience to least). Restoring and maintaining resilience would likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change related impacts and variability. Management practices that sustain healthy plant and animal communities (e.g., thinning for age class diversity and structure, reclaiming and restoring native grasslands) and provide adequate nutrients, soil productivity, and hydrologic function promote resilience and reduce opportunities for disturbance and damage.

Cumulative Environmental Consequences

Potential cumulative environmental consequences from or to other land owners, when added to the environmental consequences listed above for **all alternatives**, include the following:

- Soil loss through wind or water erosion leaving the forests or sediment coming onto the forests could reduce soil productivity.
- Airborne deposition of pollutants could reduce soil productivity; however, this is currently not contributing to a measureable reduction and it is not expected to in the future (see the "Air Quality" section).

Watershed

Watershed condition is the state of the physical and biological characteristics and processes within a watershed that affect the hydrologic and soil functions that support aquatic ecosystems. For this analysis, watershed conditions were assessed at the 6th level HUC (hydrologic unit code) which was determined to be the most appropriate scale for programmatic planning. The initial assessment of watershed condition was conducted in March 2011 using the national watershed condition framework (WCF) and assessment tool (Potyandy and Geier, 2010). The WCF provides a consistent way to evaluate watershed condition at both the national and forest levels. The WCF consists of reconnaissance level assessments by individual national forests, implementation of integrated improvement activities within priority watersheds, monitoring of watershed condition class changes, and aggregation of program performance data for national reporting. The specific watershed condition ratings by each 6th level HUC watershed can be found in the “Watershed Specialist Report” (Forest Service, 2014v) available in the “Plan Set of Documents.”

The environmental consequences section provides a qualitative assessment of forecasted trends in watershed conditions by alternative based on the concept of concentrating restoration treatments within priority watersheds and, in a more general sense, describing potential effects from forest restoration activities, recreation activities, roads, grazing, special uses, and climate change on watershed condition. The full analysis for watershed condition can be found in the “Watershed Specialist Report” (Forest Service, 2014v).

In the analysis for this resource, assumptions include the following:

- Priority watersheds are designated where the primary purpose of restoration activities would be to improve watershed condition. The selection of these watersheds is ongoing and, once selected, will be a major consideration for project implementation in some alternatives.
- The following sections qualitatively describe and compare the effects to watershed condition by the types of activities allowed under the description of the alternatives and how each alternative influences where work would be concentrated.

Affected Environment

Watershed condition reflects a range of variability from natural pristine (properly functioning) to degraded (severely altered state or impaired). Watersheds in properly functioning condition have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients similar to their reference conditions. Properly functioning watersheds create and sustain functional terrestrial, riparian, aquatic, and wetland habitats capable of supporting diverse populations of native aquatic- and riparian-dependent species. The greater the departure from the natural pristine state, the more impaired the watershed condition is likely to be, up to the point of being severely altered.

Watershed condition classification is the process of describing watershed condition by discrete categories (or classes) that reflect the level of watershed health or integrity. Watersheds with high integrity are in properly functioning condition and represent ecosystems that show little or no influence from human actions.

There are three classes to describe watershed condition:

- **Class 1 (Functioning):** Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and they are functioning properly. These are synonymous with functioning watersheds.
- **Class 2 (Functioning-At-Risk):** Watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and they are functioning, but at risk. These are synonymous with functioning-at-risk watersheds.
- **Class 3 (Impaired):** Watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and their function is impaired. These are synonymous with impaired watersheds.

Table 12 below describes the number of 6th level HUCs within each watershed basin (3rd level HUC) by watershed condition class and lists some of the common degrading factors that have reduced condition. According to the watershed condition framework, pre-Wallow Fire, 32 percent of forests' 170 6th level HUCs are considered to be functioning properly (Class 1), 68 percent are functioning-at-risk (Class 2), and less than 1 percent are considered impaired (Class 3). The assessment after the Wallow Fire revealed 21 percent of the watersheds are satisfactory, 71 percent are at-risk, and 7 are impaired, primarily due to changes in aquatic, riparian, terrestrial, and road conditions as a result of loss of cover, increased sediment, and larger peak flows.

Table 12. Results of the Watershed Condition Framework (WCF) for 6th level HUC watershed condition by watershed basin (3rd level HUC)

Watershed Basin	Total Number of 6th Level HUCs[a]	6th Level HUCs in Class 1[b]	6th Level HUCs in Class 2[b]	6th Level HUCs in Class 3[b]	Common Degrading Factors
Little Colorado River	92	23 (19)	69 (68)	0 (5)	High road density, poor aquatic habitat conditions, departed fire regime conditions, poor aquatic biota conditions
Upper Gila River	55	20 (14)	35 (39)	0 (2)	Impaired soil conditions, departed fire regime conditions, poor aquatic habitat conditions
Upper Salt River	23	11 (3)	11 (13)	1 (7)	Poor aquatic habitat condition, departed fire regime conditions
Total Percent of Total	170 100%	54 32% (36) (21%)	115 68% (120) (71%)	1 < 1% (14) (8%)	

[a] Watersheds with minor amounts of NFS lands are not tallied.

[b] Post-Wallow Fire numbers are displayed in parentheses ( ).

Figure 7 shows the 2010 watershed condition rating across the forests; while figure 8 shows the 2012 watershed condition rating. These maps display watershed conditions prior to and after the 2011 Wallow Fire. There were 50 watersheds affected by the fire. Some watersheds were heavily affected, resulting in a shift to a lower class. The effects of the fire to watershed condition in some of these watersheds were minimal.

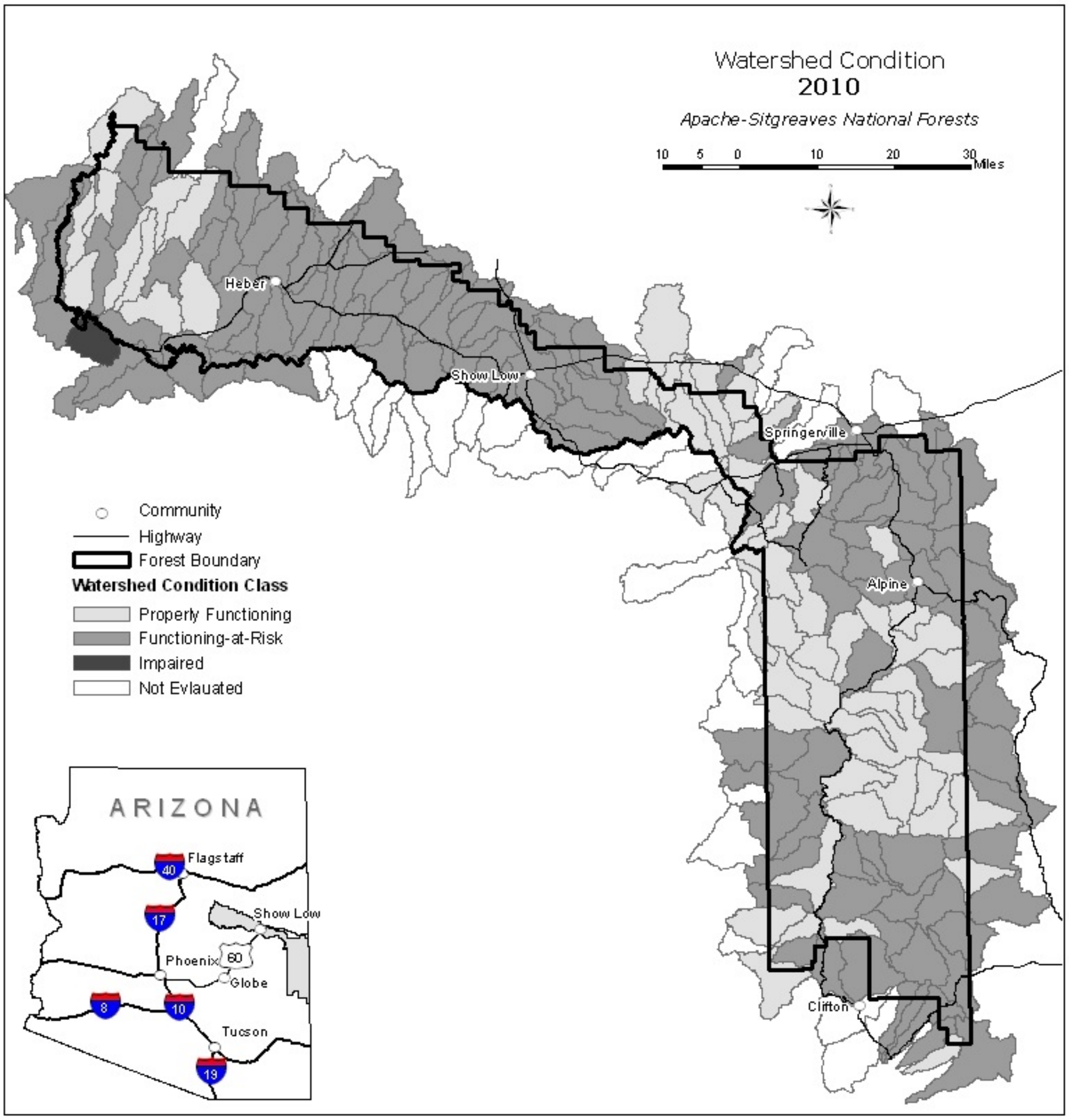

Figure 7. Map of 2010 watershed condition rating for 6th level HUC across the forests

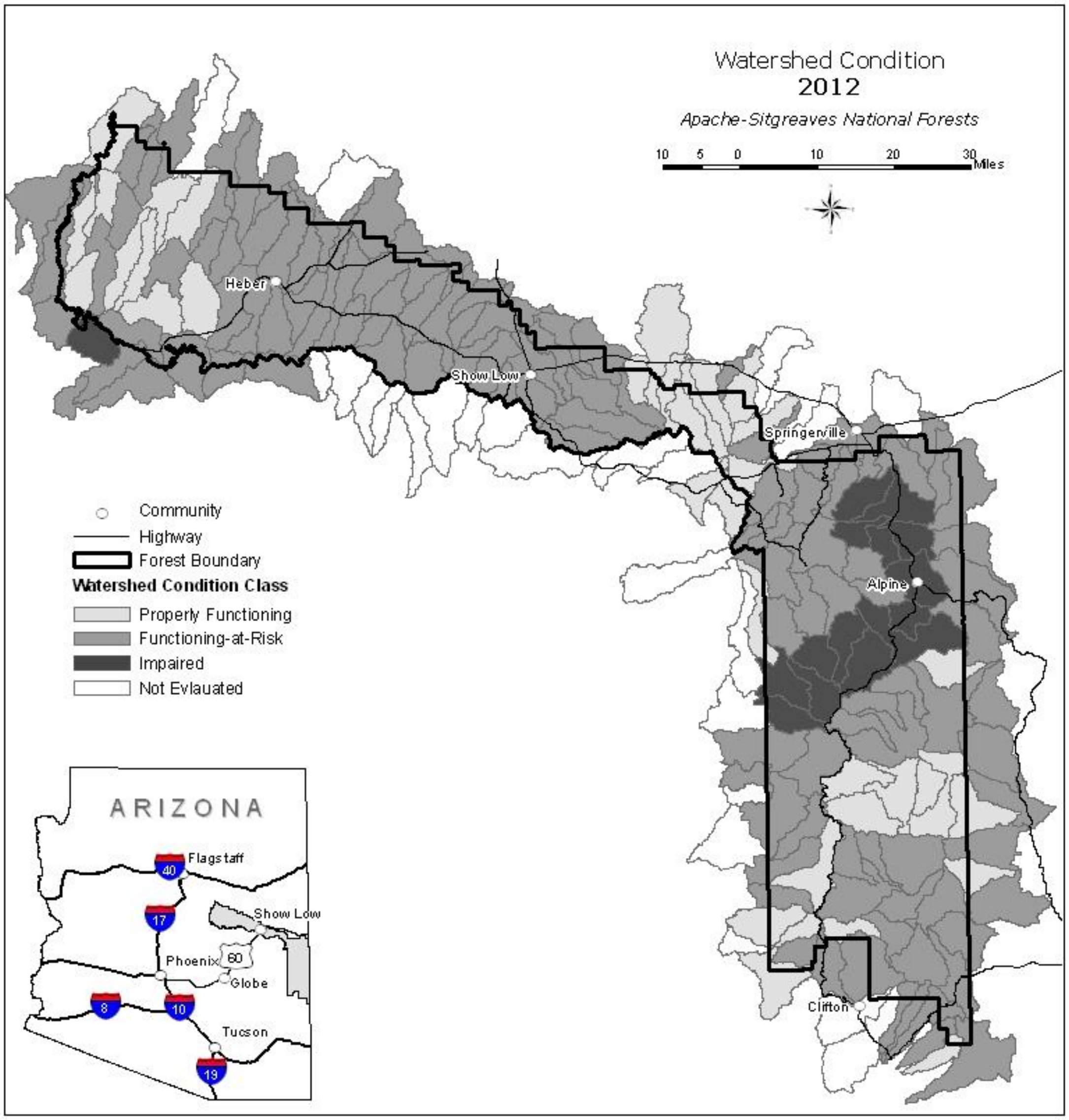

Figure 8. Map of 2012 watershed condition rating for 6th level HUC across the forests

Environmental Consequences of Alternatives

Alternatives are compared based on their ability to move watersheds toward properly functioning conditions. Ground-disturbing activities, such as restoration treatments, roads, recreation activities, grazing, and certain special uses have short- and long-term effects on watershed condition.

Forest Restoration Activities

There are a variety of treatment methods available in **all alternatives** that could improve the watershed condition, including several kinds of mechanical and wildland fire treatments. Ecological condition is currently highly departed from desired conditions in many of the PNVTs. Vegetation ecological condition affects many of the attributes used to characterize watershed condition, such as soil and riparian and aquatic habitat conditions.

Alternative A does not provide a focused approach to watershed restoration. Treatments would likely not be concentrated within priority watersheds and would not substantially remove degrading factors that cause functioning-at-risk or impaired watersheds to improve. Although the level of treatments is comparable or greater than other alternatives, it is unlikely that entire watersheds would be restored, except as opportunities arise. **Alternatives B and D** concentrate treatments in priority watersheds which allows a better opportunity for restoring or maintaining watersheds across the forests. **Alternative C** also has an objective to treat priority watersheds. However, under **alternative C**, improvement of watershed conditions would be limited to those PNVTs that can contribute to economic sustainability (e.g., ponderosa pine that is on level terrain and near transportation routes) or within the Community-Forest Intermix Management Area (table 13).

Table 13. Priority watershed treatment objective, basis, and priority by alternative

Alternative	Number of Priority Watersheds Treated in the 15-year Planning Period	Basis and Priority of Treatment Areas
Alternative A[a]	None	Reduction of hazardous fuels around communities
Alternative B	10	Restore or maintain properly functioning watershed condition and ecosystems within priority watersheds Reduce hazardous fuels within the areas identified in the Community Wildfire Protection Plans (CWPPs)
Alternative C	10	Contribute to economic sustainability Reduce hazardous fuels within the Community-Forest Intermix Management Area
Alternative D	10	Restore or maintain properly functioning watershed condition and ecosystems within priority watersheds

[a] 1987 plan as currently implemented.

Motorized Routes and Recreation Activities

The road and motorized trail system analyzed is the same for **all alternatives**. Basic road maintenance is to be completed on at least 20 percent of passenger vehicle roads and motorized trails per year and 10 percent of all high-clearance roads per year. Watershed condition would be affected by the miles of open road and trails and the level of use. In addition, there are hundreds of miles of unauthorized routes throughout the forests. Restoration objectives would consider rehabilitating the network of unauthorized routes.

Alternatives C and B have the highest potential, followed by **alternatives D and A**, for increased traffic as well as the most open roads based on the amount of acres planned to be treated mechanically. Maintenance level 1 roads are opened only during management activities—such as mechanical restoration treatments—to access and remove forest products. Opening these roads may increase up to 10 times the amount of roads open within a watershed, providing potential for increased sediment in the stream system.

The **action alternatives** implement the most treatments within priority watersheds; while **alternative A** does not emphasize treatments in these watersheds. See table 3 in chapter 2, specifically under "Type, Priority, and Amount of Restoration Treatments." Road needs would be analyzed for implementation of projects; unauthorized motorized routes would be identified for obliteration. Road networks would potentially be reduced to decrease sediment and loss of soil productivity, thereby reducing the degrading factors within priority watersheds caused by too many roads or roads in poor condition.

The **action alternatives** have an objective to remove unauthorized roads which negatively impact streams or riparian areas. **Alternatives B and D** have an additional objective to relocate, repair, improve, or decommission NFS roads that negatively impact streams or riparian areas. These actions would reduce sediment input to streams as well as returning roadbeds to production primarily within priority watersheds. **Alternative A** does not contain a similar objective, thus sediment from roads may continue to impact streams or riparian areas.

During maintenance of structures and road surfacing under **all alternatives**, BMPs would be effective in reducing sediment and improving watershed conditions. The forests would implement BMPs for road maintenance to mitigate sediment and limit the road system footprint.

Recreation emphasis in **alternative C** would favor motorized recreation opportunities and developed campgrounds. **Alternative D** would favor nonmotorized recreation opportunities and dispersed camping. **Alternatives A and B** would provide a mix. Emphasis on motorized opportunities could result in more roads and trails available for use, with more potential for soil and water degradation. Concentration of recreationists may result in more site disturbance and impacts would be compounded. Dispersed camping would tend to spread these impacts over a larger area.

Grazing Activities

All alternatives would prescribe treatments that improve the vegetation conditions on uplands to more open conditions. By reducing tree canopy, there would be a projected increase in available forage for grazing animals (see the "Vegetation" section on overstory and herbaceous understory relationships). This would provide an opportunity for reduced grazing pressure on uplands and riparian areas from both domestic and wild animals.

Alternative A would result in the least long-term improved forage condition because it would have the fewest treatments to reduce canopy cover. **Alternative C** would improve condition in only a few PNVTs, generally the open forested and piñon-juniper woodland PNVTs. **Alternative**

B and then **alternative D** would reduce canopy cover in all open canopy vegetation types, providing improved conditions in grasslands and woodlands as well as forested PNVTs. See the "Vegetation" section for detailed discussion of the relationship between the overstory and herbaceous understory vegetation cover.

BMPs and SWCPs are effective in retaining protective ground cover and would be implemented under **all alternatives**. General improvement of vegetation condition (e.g., reduced canopy cover, increased herbaceous cover) could allow for improved rangeland and watershed conditions.

Special Uses

The effects of special uses to watershed condition would be the same in **all alternatives**. Site-specific BMPs would be prescribed and would be effective in mitigating effects to soil and water quality components of watershed condition. Impacts to watershed condition can occur from group events, power line and water transmission corridors, access roads, and mineral extraction.

Climate Change

Based on current climate models, the climate change factors that may influence watershed condition are changes in water distribution, timing of precipitation, availability, storage, watershed management, and human water uses. These indicate the need to improve forest health, conserve water, and reduce fire risk, as well as prepare for increased use of forest materials and the greater demand for recreation. Concentrating restoration treatments within watersheds reduces the risk to watershed and ecological condition within entire watersheds. The **action alternatives** would move vegetation conditions toward desired conditions and reduce the risk of uncharacteristic wildfire within priority watersheds. **Alternative A** would reduce the risk to lands treated, but not on a watershed basis, limiting the effectiveness of treatments to improve watershed condition.

Cumulative Environmental Consequences

Almost all of the watersheds associated with the forests have private in-holdings and areas where the watersheds extend to outside of the forests' boundary (figure 7). Many of the impacts discussed above occur on lands of other ownership (e.g., unpaved roads, grazing, mineral materials removal, fuel treatments) and could impact the forests' watershed conditions and possibly result in reduced watershed conditions. Large-scale industry, such as industrial mining and power generating, as well as medium to large urban areas, require large quantities of water for their operations and can impact groundwater-dependent ecosystems (Forest Service 2012f). **All alternatives** would maintain or improve watershed conditions and help mitigate the effects of off-forest activities that are outside Forest Service control. Management of priority watersheds emphasizes using an "all lands" approach to enhance coordination with external agencies and partners in watershed management and aquatic species recovery efforts.

Water Resources

This section describes the current condition and potential environmental consequences to water quality, water yield, water rights, instream flow, and groundwater from implementing the alternatives. The analysis relies on qualitative comparisons and describes potential environmental consequences by major ground-disturbing activities (e.g., forest thinning, animal grazing, roads, mining, fire). More detailed descriptions of these topics can be found in the “Water Specialist Report” (Forest Service, 2014u) available in the “Plan Set of Documents.”

Water quality has been assessed in major perennial stream reaches and lakes on the forests. The general classification used for surface water quality by Arizona Department of Environmental Quality (ADEQ) designates each waterbody in one of five categories:

- **Category 1:** Attaining all designated uses.
- **Category 2:** Attaining some designated uses, and no use is threated or impaired.
- **Category 3:** Insufficient or no data and information to determine if any designated use is attained.
- **Category 4:** Impaired or threatened for one or more designated uses, but a TMDL is not necessary because
  - **4a** – A total maximum daily load (TMDL) assessment has already been completed.
  - **4b** – Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard.
  - **4c** – The impairment is caused by pollution but not a pollutant.
  - **4n** – The impairment is solely by natural conditions.
- **Category 5:** Impaired or threatened for one or more designated uses by a pollutant, and a TMDL needs to be developed or revised.

The State of Arizona sets narrative and numeric surface water standards for water quality based on the uses people and wildlife make of the water. These “designated uses” are specified in the standards for individual surface waters, or if the surface water is not named in the rule, the designated uses are determined by the tributary rule. “Attaining” means that the water quality has met State and Federal standards to fully support the assigned designated use for a water body, and data used in the determination meets the credible data requirements of the Arizona’s Impaired Water Identification Rule (A.A.C. R18-11-602).

Water quality is assessed by comparing existing conditions (categories 1 to 5) with desired conditions (standards) set by the State of Arizona under authority of the Clean Water Act (CWA). ADEQ is the regulating authority for water quality in Arizona as promulgated by the Environmental Protection Agency (EPA). Waters that are not impaired (those not on 303d[14] list or in category 4 or 5) are providing for beneficial uses identified for that stream and can be considered in a desired condition until further sampling indicates impairment. Waters in categories 2 through 5 require special attention during site-specific project analysis.

In the analysis for this resource, assumptions and methodology include the following:

[14] Under section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These impaired waters do not meet water quality standards that states, territories, and authorized tribes have set for them, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters.

- Data used in this analysis represents forestwide conditions and may not represent water quality or flow conditions at any given point. Onsite inspections will be conducted for site-specific project assessments.
- Generally, reducing canopy cover in vegetation types within higher precipitation zones will generate more runoff. This change implies changes in water yield.
- Effects to groundwater availability are discussed qualitatively using regional studies and Forest Service policies. Between the alternatives, there would be little difference from a groundwater use or quality standpoint; however, slight differences are predicted in groundwater recharge potential from the forests.
- To provide a baseline for discussion of water produced from the forests, an analysis was performed to estimate the amount of water yield that reaches surface streams which leave the forests. The analysis does not attempt to account for waters on the forests that infiltrate deep aquifers. Estimates are made for water yield from NFS land by individual 5^{th} level HUC watersheds. These estimates are then aggregated to individual 4^{th} level HUC watersheds. Similar estimates are made for the water yield from entire 5^{th} and 4^{th} level HUC watersheds containing Apache-Sitgreaves NFs lands.

Affected Environment

Water Quality

Improvements to the Nation's waters over the past 3 decades are largely due to the control of traditional point sources of water pollution. However, a large number of water bodies remain impaired and the goal of eliminating pollutant discharge and attaining fishable and swimmable waters is still unrealized. Nonpoint sources of pollution such as agriculture, construction, forestry, and mining are responsible for much of the Nation's remaining water quality impairment. The desired condition is that water quality meets or exceeds Arizona State standards[15] or EPA water quality standards for designated uses, and meets critical needs of aquatic species.

Currently on the Apache-Sitgreaves NFs, the most prevalent nonpoint source of pollution is sediment generated from sources including motorized routes in close proximity to drainages; residual effects of past, and in some cases, current livestock grazing; and short-term impacts of ground-disturbing activities such as timber harvest and higher severity fire. Before the initiation of BMPs in the 1980s, timber harvesting was widespread and was a nonpoint source of pollution in the form of sediment delivery into streams. Currently, the forests implement and monitor site-specific BMPs for all activities that have the potential to pollute surface water. Forest Service policy directs compliance with required CWA permits, State rules and regulations, and the use of approved BMPs in adaptive management strategy to control nonpoint source pollution to meet applicable water quality standards and other CWA requirements.

The following lakes and stream reaches have been identified by ADEQ as those with the most severe water quality problems. Permit requirements for discharge into these waters are very strict; ADEQ and the forests must make sure that any new discharges or modifications would not further degrade water quality.

- **Category 4 "Not Attaining."** Waters include the following: Nutrioso Creek, Little Colorado River below the Greer Lakes, Luna Lake, Rainbow Lake, and Crescent Lake.

[15] Arizona Administrative Code Title 18. Chapter 11 Arizona Water Quality Standards.

These waters have approved TMDLs with recommendations that, when implemented, are believed to improve the water quality and the ADEQ would move them into lower categories. There are 27 miles of streams in this category.

- **Category 5 "Impaired."** Waters currently on the 303d list include the following: Bear Canyon Lake, lower Blue River, and the San Francisco River below the confluence with the Blue River. These waters were not listed prior to 2006. There are 26 miles of stream within this category.

The remaining waters (about 422 miles) fall into categories 1, 2, and 3. Overall, forestwide water quality, based on data from 1987 to 2008, is improving.

The State of Arizona has also identified stream segments that are particularly pristine and where no degradation of water quality is allowed (see figure 9). These are called "Outstanding Arizona Waters," formerly known as "Arizona Unique Waters," nine of which are located in the high elevation regions east, south, and southeast of Mount Baldy Wilderness (ADEQ, 2009 and 2012):

- Bear Wallow Creek, from its headwaters to the boundary of the San Carlos Indian Reservation;
- South Fork Bear Wallow Creek, from its headwaters to Bear Wallow Creek;
- North Fork Bear Wallow Creek, from its headwaters to Bear Wallow Creek;
- Hay Creek, from its headwaters to its confluence with the West Fork of the Black River;
- KP Creek, from its headwaters to its confluence with the Blue River;
- Lee Valley Creek, from its headwaters to Lee Valley Reservoir;
- West Fork Little Colorado River, above Government Springs;
- Snake Creek, from its headwaters to its confluence with the Black River; and
- Stinky Creek, from the Fort Apache Indian Reservation boundary to its confluence with the West Fork of the Black River.

The 2011 Wallow Fire burned significant portions of the watersheds contributing to all of these streams except Lee Valley Creek. Potential effects to these streams include additional sediment and nutrients, primarily from erosion of severely burned uplands; increased flood flow intensity and frequency, which may alter streambank and streambed stability; increased amounts of debris from mass wasting due to slope instability; and increased water temperature from loss of shading vegetation. The outstanding character of these streams was based on the need to protect water quality to support the cold water fisheries designated use (primarily for protection of Apache trout habitat). To date, the forests and ADEQ have yet to determine the current status of these streams or determine what actions may be required to mitigate the effects of the Wallow Fire. Wildfires are unplanned events and can be of natural origin, human-caused, or escaped prescribed fire; natural recovery can be allowed based on the State's anti-degradation policies.

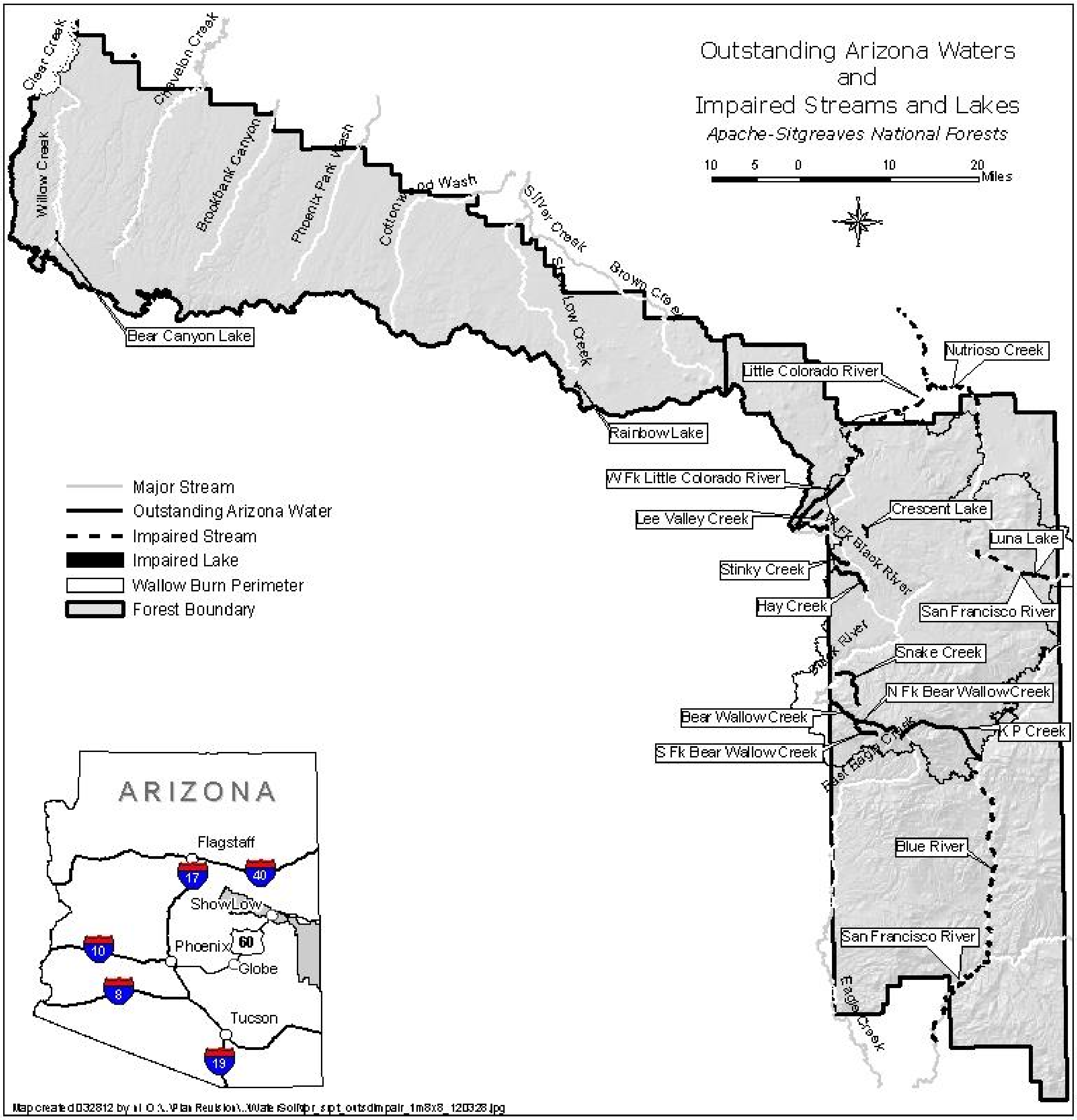

Figure 9. Map of Outstanding Arizona Waters and impaired streams and lakes

Water Yield

Streamflow is directly dependent on annual precipitation, including snowpack. Overall, the current trend in water yield appears to be static or slightly reduced over time as tree density increases. Additionally, climate change predictions for the Southwest favor higher temperatures and increased drought occurrence. More evapotranspiration and earlier snowpack melt are predicted, which may affect available water in the forests.

Development in the Southwest has been primarily dependent upon technology to deliver water resources. The locations of most snowpack and upland reservoirs are on national forests in the Southwest (Smith et al., 2001; State of New Mexico, 2005). There are an estimated 3,771 surface acres of perennial lakes and ponds within the Apache-Sitgreaves NFs (Forest Service, 2008e). The forests also contain many of the headwater streams for the Little Colorado, Salt, and Upper Gila River Basins. The Apache-Sitgreaves NFs receive a large portion of Arizona's annual snowpack. Current estimated water yields from the Apache-Sitgreaves NFs are roughly 384,650 acre-feet per year (Forest Service, 2008e), the majority going to the greater Phoenix metropolitan area.

Although there are no designated municipal watersheds within the forests, many local communities and individuals depend on water generated from the forests through springs, streams, and groundwater pumping for domestic, irrigation, and some industrial/agricultural uses.

Periodic flooding is a natural disturbance necessary for maintenance of stream channels and many riparian plant species. Occasionally, high flow causes damage to road infrastructure and other manmade structures. Flooding is more common after large high severity wildfires, where protective vegetation is removed and soil structure is altered. In severely burned watersheds, studies show peak flows (the highest flow rate measured after a storm event) can be slightly to thousands of times higher than the pre-fire flow rate (Neary et al., 2005) as was observed during the summer rainstorms after the Rodeo-Chediski Fire near Heber, Arizona (Folliott and Neary, 2003).

Other damaging flow events have occurred during very high intensity summer rainstorms or when a warm rainstorm falls over a melting snowpack, such as occurred in 1992 in the Willow Creek watershed east of Heber, destroying the concrete bridge at Wiggins Crossing. Flooding and debris flows have occurred as a result of the 2011 Wallow Fire, including extreme runoff events from summer thunderstorms within numerous small watersheds. Flood events may continue for many years; damage is expected to be somewhat localized under normal rainfall conditions, the communities of Eagar, Nutrioso, Tal WiWi, Alpine, Blue, and Greer are at risk for flooding.

Water Rights

The current trend of surface water use by the forests is static. The forests' consumptive use is expected to remain static into the future, as surface water in Arizona is considered to be fully appropriated. Water rights adjudications are proceeding slowly, and will eventually dictate the amount and ownership of surface waters within the forests. According to Arizona Department of Water Rights (ADWR) Statement of Claim filings for water rights, there are over 2,240 stock tank claims located on the forests. The forests have a total of 3,547 forest owned claims and certificates. These claims include several watershed level reserved water right claims allowing use of water for firefighting and road maintenance.

Instream Flow

Instream flow water rights are unique rights created by Arizona to protect the State's fisheries and associated riparian resources in selected stream segments. They are fundamentally different from appropriated water rights since they are non-consumptive. Under Arizona law, the instream flow water rights the Forest Service is applying for do not allow use from the stream; the Forest Service cannot divert or interfere with surface water flow and cannot affect any existing (senior) water rights. The Forest Service is applying for these rights to ensure the minimum flows needed for fish, wildlife, and water-based recreation are protected from future claims on these waters. There is no other mechanism available to maintain sufficient flows in the streams, which are critical to protect wildlife habitats and tourism-based economies in rural Arizona. With instream flows provided for, the water may still be available for future appropriation; however, it must be taken after the water leaves the national forest boundary or only at a time when streamflows are not below the minimum base flow levels set by the permitted right. The forests' program to acquire instream flow rights is summarized in the "Water Specialist Report" (Forest Service, 2014u).

Groundwater

Water resources are obtained from surface water runoff, shallow perched water-bearing zones (which generally do not provide a useful water source), and very deep regional aquifers. Although not well understood, groundwater is connected to surface water and where groundwater is pumped at a rate greater than recharge, connected surface water flow is reduced. Groundwater recharge occurs throughout all watersheds but is greatest at higher elevations where precipitation is greater and in areas with heavily fractured rock units.

Figure 10. Map showing extent of the Coconino-De Chelly Aquifer (C Aquifer).

Groundwater pumping outside of designated active management areas[16] is not limited by current Arizona groundwater codes. One of the three basins (Little Colorado) associated with the forests have documented groundwater pumping to some level greater than inflow (ADWR, 2009a, 2009b, and 2009c; Feth and Hem, 1963; Freethey and Anderson, 1986; Hart et al., 2002). Reference conditions are described as being in a steady state, or where inflow equals outflow. Continued or increased pumping may negatively affect base flow of streams directly connected to major aquifers, such as Chevelon Creek and Tonto Creek, which are tied to the Coconino-De Chelly Aquifer (C Aquifer) (Hart et al., 2002). Groundwater pumping within the C Aquifer may negatively affect aquatic habitat and the amount of water forest wells can access for stock watering and domestic use as groundwater levels are drawn down. See figure 10 for location of the C Aquifer.

Environmental Consequences of Alternatives

Water Quality

Trend

The trend in **all alternatives** would be toward desired conditions. Water quality monitoring provided by ADEQ would continue to result in a reduction of Category 5 (impaired) reaches and

[16] The 1980 Arizona Groundwater Code recognized the need to aggressively manage the State's finite groundwater resources to support the growing economy. Areas with heavy reliance on mined groundwater were identified and designated as active management areas (AMAs). There are five AMAs: Prescott, Phoenix, Pinal, Tucson, and Santa Cruz.

lakes through completion of TMDL plans. Water quality was improving throughout the forests until the 2011 Wallow Fire occurred. Water quality monitoring is needed to determine new baseline levels and establish recovery rates for Arizona Outstanding Waters, as all but one was affected to some extent by the Wallow Fire. Implementation of BMPs would reduce water quality impacts from all land-disturbing projects and protect Outstanding Arizona Waters from long-term water quality degradation.

Forest Restoration Activities

Mechanical Treatments

Although much of the effects to water quality from mechanical treatments are mitigated through BMPs and soil and water conservation practices (SWCPs), there may be short-term sediment pulses from activity roads, skid trails, and landings. **Alternative C** would prescribe the most mechanical treatment and, therefore, would have the highest risk to water quality, followed by **alternatives B, D, and then A**. At the project-level, site-specific mitigation would reduce impacts to water quality below significant levels under **all alternatives**.

Timber harvest and restoration treatment activities have the potential to adversely affect water resources. Typical ground disturbance includes use and maintenance of motorized routes, skid trails, log landings, and stream crossings (Litzchert and MacDonald, 2009). In addition to erosion and sedimentation, impacts may include vegetation loss in riparian areas, effective extension of the channel network through roads and skid trails connecting upstream disturbances to streams, and channel damage from higher flows (generated from canopy reduction) within the contributing watershed area.

Additional impacts from timber harvest, forest restoration activities, and prescribed fire may include the contamination of water or wetlands from chemical substances (e.g., gasoline, oil, hydraulic fluid) that leak from equipment used on the forests. There are also potential effects from chemicals (e.g., herbicides) used for site preparation, timber stand improvement, and treatment of invasive plants associated with timber harvest activities.

Erosion that results from timber harvest activity is generally temporary and usually returns to pre-harvest erosion rates within 2 years. Effectiveness monitoring and research have shown that proper implementation of BMPs and SWCPs greatly reduce erosion, compaction, sedimentation, and other water quality impacts (Forest Service, 2007d and 2008h; EPA, 2005). In addition, streamside management zones or vegetative filters would be prescribed for all streams to minimize impacts from all ground-disturbing activities. The width of these filter strips would vary based on stream order, type, slope, erosion hazard of adjacent uplands, and protection status (e.g., federally listed critical habitat, Outstanding Arizona Water) (Forest Service, 2008c). Activities that are allowed in streamside management zones are modified in degree, extent, or timing to minimize sediment and wildlife habitat modification (e.g., hand thinning, no treatments in breeding season).

Wildland Fire Treatments

Although much of the effects to water quality from wildland fire treatments would also be mitigated through BMPs and SWCPs, there may be short-term sediment and ash pulses from higher severity burn areas within fire areas. **Alternative D** would prescribe the most fire treatment acres and, therefore, the greatest risk to water quality, followed by **alternatives B, C,**

and then A. At the project-level, site-specific mitigation would reduce impacts to water quality below significant levels under **all alternatives**.

The effects of wildland fire on water quality would vary depending on fire intensity, type and amount of vegetation burned, soil moisture, proximity to streams, weather conditions, and burning techniques. The magnitude of the effects of fire on water quality is primarily driven by fire severity. Fire severity is a qualitative term describing the immediate effects of fire on vegetation, litter, or soils. Fire intensity is a key component of burn severity and refers to the rate at which a fire produces heat at the flaming front and is expressed in terms of temperature or heat yield. Moderate or high intensity fires consume more fuel and release more nutrients than low intensity broadcast burns. Additionally, areas affected by moderate and high severity fires are more susceptible to soil erosion and releasing nutrients into streams where water quality can be degraded (Neary et al., 2005). Burning prescriptions would be designed to limit fire intensity to only the level needed to meet resource objectives for the area. BMPs are prescribed for all wildland fires and have shown to be effective in reducing sediment to streams through the use of filter strips and implementation strategies.

There is little evidence that sedimentation or water yield increases significantly in streams from forested lands burned according to a prescribed fire plan that is designed to meet resource objectives (e.g., wildlife, recreation, watershed, vegetation, ecological) (Neary et al., 2005).

Wildland fire under higher intensity conditions can result in water quality degradation. Physical changes of soil cover and structure would lead to additional runoff and sediment loss. Water flows in watersheds when burned under higher intensities high severity are typically high volume and of short duration, which can increase channel erosion and loss of floodplains from extensive flooding (Neary et al., 2005). High intensity fires in riparian areas can result in higher burn severities by removing protective vegetation and large wood needed to retain vertical and horizontal stability.

Motorized Routes

Alternative C would provide the greatest potential for increasing sediment from roads and motorized trails as it has a higher proportion of mechanical treatments/harvest as well as increased emphasis in motorized recreation opportunities. Less mechanized harvesting and restoration treatment acres would be proposed in **alternative B**, followed by **alternative D**, where more wildland fire and nonmotorized recreation opportunities are emphasized, and finally **alternative A**.

Numerous studies have identified unpaved roads as a major source of sediment in forested watersheds (Elliot and Foltz, 2001; Burroughs and King, 1989). Roads near streams have the greatest impact on water quality, as there is less area to filter sediment. Increased road density (miles per unit area) increases drainage density and can also increase the size of peak flows as it reduces the time to concentration of flows. This increases the proportion of sediment delivered as water at higher flows has more energy to scour and carry sediment (Wemple et al., 2001; Troendle and Olsen, 1994).

Road erosion can be reduced over native raw roads by surfacing with gravel, lining inside ditches with riprap, revegetating cut and fill slopes, and minimizing maintenance of road surfaces and ditches (Burroughs and King, 1989). Newer road designs include vegetative filter strips, more frequent drainage features, outsloping of the road surface to disperse road runoff, and narrower road surfaces to reduce the size of the road tread, cut slopes, and fill slopes. Whenever possible, roads would be relocated in upslope or ridgetop positions rather than along drainages. Temporary roads would be removed and revegetated following use.

Recreation Activities

Recreationists are drawn to water as evidenced by the fact that most of the forests' campgrounds are in close proximity to lakes and rivers. **All alternatives** emphasize maintenance of existing developed recreation sites. Managed campgrounds and picnic areas are hardened and provide a more efficient setting for managed access to water, as well as human and animal waste, as compared to dispersed camping. In the **action alternatives**, there is guidance to locate dispersed campsites away from streams or sensitive areas, and facilities or developments could be provided for protection of the environment rather than the convenience of visitors. **Alternative A** does not contain this guidance and would allow campsites to be located in close proximity to the forests' waters. This concentrated unmanaged recreation use would continue to cause damage to vegetation; soil compaction and erosion; and water pollution from human and animal waste, dishwashing, trash, and vehicle fluids.

Grazing Activities

The **action alternatives** would reduce pressure on riparian areas by improving upland vegetation condition (forage condition), thereby reducing impacts to water quality from grazing (see the "Vegetation" section on overstory and herbaceous understory relationships). In addition, the **action alternatives** would concentrate restoration efforts in priority watersheds. These alternatives would provide comprehensive restoration on a watershed basis and have the most opportunity for improving water quality. **Alternative A** would provide fewer opportunities for improved forage conditions that would relieve grazing pressure in and around the forests' waters.

Water quality can be affected by grazing activities in many ways. Consumption and trampling of vegetation and compaction or displacement from animal hooves in riparian areas reduces streambank stability and can change vegetation composition from the potential spread of noxious weeds. Loss of vegetation reduces the ability of a stream to trap and hold sediment in floodplains and may reduce shading of the stream. Defecation and urination into streams can reduce water quality. Overgrazing can diminish upland conditions, which in turn, may increase storm flows that potentially add sediment to streams reducing water quality.

All of these factors are mitigated, to some extent, with the implementation and monitoring of BMPs and SWCPs for grazing. As allotment management plans are revised and BMPs are incorporated into daily livestock management, degrading factors (mentioned above) to water quality are diminished.

Special Uses

In **all alternatives**, terms and conditions of special use permits would require site-specific BMPs to provide for protection of water quality. All alternatives would allow authorization of occupancy and use of NFS lands based on public need when services or uses cannot be met on private or other Federal lands.

Climate Change

Effects to water quality from climate change are similar to effects to soil condition. **All alternatives** would reduce vulnerability to the effects of climate change by moving ecosystems toward vegetation desired conditions. Unlike **alternative A**, the **action alternatives** would provide an approach to restore priority watersheds, allowing opportunities to provide the highest quality water within those treated watersheds. **Alternative A** trends would move ecosystems toward desired conditions at the slowest rate.

Water Yield and Water Rights

Trend

Industrial and municipal use of the Coconino-De Chelly Aquifer is estimated to be above the recharge rate (Hart et al., 2002.) and would be expected to continue under **all alternatives**. Water use is expected to remain static over the planning period, as water is considered to be over-allocated in Arizona. The forests' major water uses include firefighting, road maintenance, and domestic and wild ungulate watering, with minor amounts for administrative use. Water yields are expected to increase slightly because of implementation and maintenance of ecological restoration treatments that result in more open forests and improved woodland and grassland conditions.

Forest Restoration Activities

Alternative C would generate the most increased water yield, followed by **alternatives D, B, and then A**. Following timber harvest, there is a potential short-term increase in water yield or quantity in the harvest units. However, annual water yield for a watershed is only measurable when 25 percent or more of the timber volume in a watershed is removed, especially in areas receiving more than 18 inches of precipitation per year (Troendle and Olsen, 1994; Troendle et al., 2001; Grant et al., 2008; Brown et al., 1974; Rich and Thompson, 1974). Therefore, alternatives that reduce canopy cover in forested PNVTs would generate additional runoff. Generally, as the treatment areas revegetate and begin absorbing soil moisture, water runoff returns to pre-harvest levels. However, desired conditions for much of the forested PNVTs require converting the currently closed overstory condition to open. As these areas would be maintained at a much lower canopy cover over time, water yield increases should remain.

Streamflow responses to prescribed broadcast fire would be smaller in magnitude than the responses to high severity wildfires. Prescribed burning generally leaves portions of the organic soil surface (DeBano et al., 1996). Increases in streamflow discharges are much lower following prescribed fire than as those resulting from high severity wildfires.

Motorized Routes

Since the road and motorized trail system (miles, location, and maintenance level) is similar for **all alternatives**, there would be no difference in water yield expected.

Recreation Activities

Across **all alternatives**, there are no new dams or other impoundments planned for recreation within the forests' boundary that would require additional water use. Maintenance of existing dams would continue, which may involve rebuilding of spillways and sealing the core. However, no additional capacity is expected to be added.

Grazing Activities

All alternatives would provide for some increase in water yield which may provide more reliable waters for livestock use, especially in areas with greater than 18 inches of precipitation. Areas in lower precipitation zones would probably not have much of an increase from restoration treatments.

For a pasture to be available for grazing, it has to have sufficient, nutritious forage and adequate water availability. Some pastures rely on wells and developed springs to water livestock, but many utilize tanks built with native materials to capture runoff from snowmelt and rainfall for later use. During the recent droughts, many dirt tanks on the Apache-Sitgreaves NFs dried up, making many pastures unusable for cattle even though forage may have been available. The 2,240 stock tanks have altered water supply to some of the forests' streams. By far, most of these impoundments are found in ephemeral drainages. Many provide for sediment capture; however, their maintenance often releases or creates sediment that eventually travels to forest streams.

Special Uses

There are no projected differences between **all alternatives** for special uses. Easements and special use permits to transmit water from water sources, such as springs and streams, to private or public holdings are common on the forests. These are subject to terms and conditions that require demonstrating proof of water right ownership and monitoring of flows. Other terms require maintenance of structures and mitigation of possible resource damage. New special uses for water transmission would require mitigation of damage to downstream uses.

Pumping of groundwater near streams has the potential to reduce streamflow (Forest Service, 2008e). Forest Service policy states that groundwater tests are required to demonstrate whether groundwater-dependent ecosystems (Forest Service, 2012f) are affected. Special use permits may be denied or uses would be mitigated to prevent loss of riparian habitat or aquatic species. No new groundwater pumping projects are planned on the forests at this time.

Climate Change

Changes in water distribution, timing of precipitation, availability, storage, watershed management, and human water uses may present some of the most important challenges of climate change and national forest management in the Southwest. Terrestrial and aquatic ecosystems and human socioeconomic systems depend on water. Two scenarios are discussed: wetter/warmer and drier/warmer.

In wetter climate scenarios, the potential for flooding is very likely to increase because of earlier and more rapid melting of the snowpack, with more intense precipitation. Even if total precipitation increases substantially, snowpack would likely be reduced because of higher overall temperatures. However, it is possible that more precipitation would also create additional water supplies, reduce demand, and ease some of the competition among competing uses (Joyce et al., 2001; Smith et al., 2001).

In contrast, a drier climate scenario is very likely to decrease water supplies and increase demand for such uses as agriculture, recreation, aquatic habitat, and power, thus increasing competition for decreasing supplies (Joyce et al., 2001). Overall, these trends would increase pressures on the already limited water supplies in the Southwest, increase energy demand, alter fire regimes and ecosystems, create risks for human health, and affect agriculture in the region (Swetnam and Betancourt, 1997; Sprigg and Hinkley, 2000).

Some studies predict water shortages and lack of storage capabilities to meet seasonally changing river flow and transfers of water from agriculture to urban uses, as critical climate-related impacts to water availability occur (Barnett et al., 2008). Without upland reservoirs and watersheds (e.g., Little Colorado, Salt, and Upper Gila River Basins) important to Arizona’s largest metropolitan center located on the Apache-Sitgreaves NFs, alternative water sources, water delivery systems, and infrastructure support for agriculture would need to be developed (Lenart, 2007).

Effects to water yield from climate change are similar to effects to soil condition and water quality. Reduced vulnerability to the effects of climate change is provided by returning ecosystem health to desired conditions. Alternatives that reduce canopy cover in higher precipitation zones would allow for more water storage and yield as there is less interception and transpiration loss. **Alternatives D, B, and then C** would move ecosystems toward vegetation with more open canopies, while **alternative A** would trend toward desired vegetation conditions at the slowest rate.

Cumulative Environmental Consequences

Water Quality

The cumulative environmental consequences are spatially bounded by an area much larger than the Apache-Sitgreaves NFs. Some effects are limited to local watersheds, while some can have effects downstream of the forests within the three major watershed basins: the Upper Gila, Little Colorado, and Salt River watersheds. The forests are considered headwaters to these major river systems.

Cumulative effects to water quality are the result of impacts in both time and space. Many of the kinds of impacts to water quality off-forest (e.g., private, local and State governments, other Federal agencies) are similar to those on NFS lands, such as effects of roads, grazing, material removal, recreation, and fuel reduction/restoration treatments. Others impacts are not the same, such as urbanization, industrial mining, manufacturing, and power generation. Some are considered point sources of pollution and must meet stringent requirements for release of pollutants.

Acidity in rain, snow, fog, and dry deposition can affect soil fertility and nutrient cycling and can result in acidification of lakes and streams. Sulfate deposition to sensitive watersheds results in increasing soil and surface water acidification. Deposition of excess nitrogen (nitrate and ammonium) in both terrestrial and aquatic systems can acidify streams, lakes, and soils. Aquatic ecosystems in Arizona are generally well buffered and not subject to episodic or chronic acidification except at the highest elevations in and around Mount Baldy Wilderness. There are pollution sources around the forests known to emit elements that form acids of sulfur and nitrogen. The forests’ waters are currently not impacted by airborne deposition to the extent there is a measureable reduction in water quality; they are not expected to be in the future (see the “Air Quality” section).

Since the trend of water quality under **all alternatives** would be toward desired conditions, this would reduce or dilute possible off-forest effects of potential pollutants and provide better water quality to downstream users. **Alternatives B, D, C, and A**, in order, provide for this overall water quality improvement.

Water Yield and Water Rights

There are documented studies of effects of groundwater pumping on the Colorado Plateau predicting that streams and wells on the forests would be impacted. Projected population growth would put higher demands on surface and groundwater resources and, therefore, more pressure to provide water could be placed on Federal managers. Implementation of **all alternatives** are expected to slightly increase the amount of water leaving the forests and provide more water for aquifer recharge due to the expected reduction of vegetation transpiration and interception (Brewer, 2008; Baker et al., 1999) and general improvement of watershed conditions.

Riparian

This section examines the current trend of riparian condition and function. A qualitative estimate of the riparian condition trend for each alternative is provided, as well as the potential effects from management activities.

Four riparian PNVTs are classified within the Apache-Sitgreaves NFs: cottonwood-willow riparian forest, mixed broadleaf deciduous riparian forest, montane willow riparian forest, and wetland/cienega riparian areas. These PNVTs are described in detail in the “Vegetation” section. The full analysis of riparian condition and function can be found in the “Riparian Specialist Report” (Forest Service, 2014q) available in the “Plan Set of Documents.”

Since the mid-1990s, the forests have utilized the proper functioning condition (PFC) (BLM, 1998 and 2003) protocol to determine condition of riparian areas. The protocol is a consistent approach to determine how well physical processes are functioning. It is a qualitative assessment based on quantitative science.

Streams and wetlands are classified in the protocol as follows:

- **Proper Functioning Condition (PFC):** Riparian and wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to
    - dissipate stream energy associated with high flows, thereby reducing erosion and improving water quality;
    - filter sediment, capture bedload, and aid in floodplain development;
    - improve floodwater retention and groundwater recharge;
    - develop root masses that stabilize stream banks; and
    - develop diverse ponding and channel characteristics to provide habitat for fish, waterfowl and other uses, and support greater biological diversity.

- **Functioning-at-Risk (FAR):** Riparian and wetland areas that are in functional condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation[17].
- **Nonfunctioning (NF):** Riparian and wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows, and they are not reducing erosion or improving water quality.
- **Unknown**: Riparian and wetland areas that managers lack sufficient information on to make any form of determination.

In the analysis for this resource, the following assumption applies:

- Motorized cross-country vehicle use in riparian areas would be limited to occasional crossings on designated roads and trails in **all alternatives**.

Affected Environment

Riparian areas are basic to the hydrologic function of watersheds. They are terrestrial ecosystems characterized by hydric (wet) soils and plant species that are hydrophilic or dependent on the water table or its capillary fringe zone. Riparian areas include springs, seeps, streams, ponds, lakes, and their associated wet areas and floodplains. Riparian areas collect and transport water, soil, and organic material from upslope and upstream. Even though they make up less than 3 percent of the forests' land, they compose the most potentially productive and diverse components of forest and range ecosystems. Fish, wildlife, and many plant species depend on riparian areas for their existence.

Many of the forests' streams have been altered to the point where the change in stream channel morphology has resulted in drops in water tables and loss of floodplains where excess sediment can be stored. This change negatively affects the abundance, distribution, and reproduction of native riparian vegetation, especially willows and cottonwoods. The effects of past activities have reduced the overall potential of the riparian resource to provide wildlife habitat needed for species. Overgrazing has been observed to reduce effective vegetative ground cover and riparian vegetation, which contributes to accelerated erosion and soil compaction (Forest Service, 1991; Tellman and Yarde, 1997; Knutson and Naef, 1997), as well as sedimentation into connected perennial waters. Elk grazing is largely uncontrolled and have been observed in riparian areas, especially in unfenced wetlands.

The Wallow Fire in 2011 also affected riparian areas throughout its extent. The effects of the fire potentially degraded riparian areas directly as riparian vegetation was burned and indirectly as fire removed protective vegetation and litter within the watersheds causing increased streamflow energy that resulted in changes in stream channel stability. Recent observations in many riparian areas reveal a range of little change from fire effects to severe degradation in specific riparian areas from channel cutting, sediment deposition, and, in extreme cases, debris flow. Forest personnel are still evaluating the effects to riparian as funding and workload allow. It will take many years to understand the full effects of the Wallow Fire on riparian areas.

The current vegetation and soil conditions and trends in relation to desired conditions in all four riparian PNVTs are displayed in table 14 below. The trend is measured by the movement toward

[17] The term degraded means "a decline in the viability of ecosystem functions and processes" (Armantrout, 1998).

or away from desired conditions. Trend is based on a qualitative analysis of threats and risks to riparian function for each riparian PNVT. Apparent trend is estimated for each PFC assessment discussed in the “Riparian Specialist Report” (Forest Service, 2014q). Desired conditions for riparian and wetlands are based on the function of riparian vegetation through hydrologic, vegetation, and erosion/deposition processes and attributes. In general, the desired condition for riparian areas and wetlands is to be in proper functioning condition.

Table 14. Riparian vegetation and soil condition trends

Riparian Vegetation (PNVT)	Current Riparian Vegetation Condition Trend[a]	Current Riparian Soil Condition Trend[b]
Cottonwood-Willow Riparian Forest (15,876 acres)	Away	Away
Mixed Broadleaf Riparian Forest (9,657 acres)	Away	Away
Montane Willow Riparian Forest (4,808 acres)	Away	Away
Wetland/Cienega Riparian Areas (17,900 acres)	Away	Away

[a] See the “Vegetation” section

[b] See the “Soil” section

Riparian Areas Along Streams

There are over 2,800 linear miles of riparian areas on the forests. Approximately 24 percent of riparian areas are in proper functioning condition (PFC), 68 percent are functioning-at-risk (FAR), and 8 percent are nonfunctioning (NF) (table 15). Effects of past grazing, logging and roads, flooding, and periods of drought have degraded riparian conditions (Forest Service, 2008e). Based on current trends, PFC areas are expected to remain in the same condition based on BMP implementation for road, timber, and grazing management. The FAR areas remain static or show downward trend where negative effects of activities are beyond the forests’ control or show upward trend where BMPs and other mitigations are effectively protecting riparian values.

Although there is a public perception that riparian areas are fragile, current information indicates that riparian systems are often resilient. Once stresses (e.g., livestock grazing, wildland fires, dirt roads) are relieved, these riparian systems can regain their equilibrium within a few years because of resilient, native, herbaceous, riparian plants (Baker et al., 1999). Nonnative bluegrass dominated riparian areas have converted to native sedges where stressors have been reduced (AZGFD, 2000–2010). In other cases, such as in large systems where a large wood matrix is needed to overcome accelerated channel dynamics (e.g., the Blue River), the riparian system may take decades to reach PFC, even with the removal of direct impacts (National Riparian Service Team, 2000). Upland watershed conditions can also affect recovery of riparian and stream channels. Upland watershed areas that have been altered by high severity fire or intensive management treatments can reduce resistance to flow and water storage onsite and lead to increased and often damaging runoff.

Table 15. Riparian stream length and proportional extent by proper functioning condition class for 4th and 5th level HUC watersheds (Forest Service, 2008e)

4th Level HUC Watershed	5th Level HUC Watershed	Riparian Condition[a] (miles and percent of watershed)						
		PFC	%	FAR	%	NF	%	Total Miles
Little Colorado River Headwaters	Nutrioso Creek	58	42	81	58	0	0	139
	South Fork Little Colorado River-Little Colorado River Headwaters	79	58	54	40	3	2	137
	Coyote Creek	4	15	21	82	1	3	25
	Carnero Creek-Little Colorado River Headwaters	2	15	10	85	0	0	12
Upper Little Colorado River	Big Hollow Wash	0	0	2	100	0	0	2
	Oso Draw	5	10	50	90	0	0	55
Silver Creek	Show Low Creek	4	7	53	88	3	5	60
	Upper Silver Creek	0	0	11	54	10	46	21
	Cottonwood Creek	8	5	136	80	27	16	171
Middle Little Colorado River	Phoenix Park Wash-Dry Lake	0	0	38	88	5	12	43
	Upper Clear Creek	49	29	84	50	34	21	167
	Lower Clear Creek	14	100	0	0	0	0	14
Chevelon Canyon	Upper Chevelon Canyon	123	53	92	40	16	7	231
	Black Canyon	0	0	60	49	64	51	124
	Lower Chevelon Canyon	0	0	3	74	1	26	4
Mangus Creek-Upper Gila River	Apache Creek-Upper Gila River	8	29	19	71	0	0	26

4th Level HUC Watershed	5th Level HUC Watershed	Riparian Condition[a] (miles and percent of watershed)						
		PFC	%	FAR	%	NF	%	Total Miles
San Francisco River	Centerfire Creek-San Francisco River	8	11	58	84	3	5	69
	Upper Blue River	86	28	195	65	21	7	302
	Pueblo Creek-San Francisco River	0	0	12	100	0	0	12
	Lower Blue River	92	29	200	64	21	7	312
	Mule Creek-San Francisco River	27	22	86	70	9	8	123
	Chase Creek-San Francisco River	22	36	32	51	8	13	62
Upper Gila River-San Carlos Reservoir	Upper Eagle Creek	61	34	109	61	11	6	181
	Lower Eagle Creek	56	43	66	51	7	6	129
Black River	Upper Black River	54	15	299	81	14	4	368
	Middle Black River	23	45	28	55	0	0	51
White River	Upper North Fork White River	0	0	1	100	0	0	1
Upper Salt River	Canyon Creek	8	60	5	40	0	0	13
Carrizo Creek	Carrizo Creek (local drainage)	0	0	3	100	0	0	3
Total Miles and Average Percent		791	24	1,808	68	258	8	2,857

[a] Riparian condition ratings are PFC = proper functioning condition, FAR = functioning-at-risk, and NF = nonfunctioning. Total miles may not equal mileages in the rating categories due to rounding.

Wetlands

All wetlands on the Apache-Sitgreaves NFs have been mapped; however, not all wetlands have been assessed in detail. There are about 7,000 acres of wetlands on the forests. Conditions of a limited number of wetlands have been determined through the use of the PFC protocol. Others have been described and evaluated for suitability for waterfowl and threatened and endangered species habitat. Many of the forests' wetlands are small and only seasonally wet. Little more than anecdotal information is available to document the reference condition, extent, and conditions of wetland and riparian areas. However, Cline (1976) inferred that wetland conditions prior to Euro-

American settlement (early 1800s) was probably dominated by proper functioning condition, because there was little human disturbance compared to today. Datasets from 1913 to 1915 describe various areas known today as reservoirs—such as Sierra Blanca Lake—as large wetlands (Riblett et al., 1915). More recent aerial photo analysis (post 1940) indicates wetland extent then was about the same as it is today. Current disturbances are similar to those listed in the “Water Resources” section. Nonfunctional wetlands include those that have been artificially drained by the practice of creating pit tanks for livestock watering. Others have been enhanced through watershed and wildlife improvement projects.

Environmental Consequences of Alternatives

In **all alternatives**, environmental consequences within the foreseeable future to riparian areas and wetland ecosystems from management activities (timber harvesting/forest restoration) are expected to be minor. This is because project design incorporating BMPs, aquatic management zones, and wildlife habitat mitigation would be implemented; riparian areas and wetland ecosystems would be avoided; and new road construction related to timber harvesting is not expected to occur. Livestock grazing would continue into the foreseeable future throughout the planning area; continued impacts to riparian areas and wetland ecosystems may occur. Continued monitoring and adaptive management applied to livestock grazing would aid in minimizing impacts to riparian areas and wetlands.

Trend

The current trend is away from desired conditions in all riparian PNVTs. There are no specific objectives in **alternative A** regarding treating the riparian vegetation structure or composition or treating roads that impact riparian condition; therefore, the trend is estimated to be away. **Alternatives B and D** have objectives to treat riparian areas as well as remove roads that impact riparian condition; therefore, some positive trend is expected. Although **alternative C** does not have specific objectives to treat the riparian vegetation, it does contain an objective to remove unauthorized routes and unneeded maintenance level 1 roads; therefore, some positive improvement is expected. **All alternatives**, in most PNVTs, would result in improving upland watershed conditions, which would result in an improvement in riparian condition. See table 3 in chapter 2, specifically under “Type, Priority, and Amount of Restoration Treatments.”

Reduction in canopy cover is expected to improve forage conditions in most PNVTs (see the “Vegetation” and “Livestock Grazing” sections), resulting in less demand by grazers to use riparian areas. **Alternatives B and D** additionally would provide for direct treatment of riparian streams and roads currently impacting riparian areas. **Alternatives A and C** would provide for improvement of upland conditions which would indirectly contribute to riparian improvement.

Forest Restoration Activities

Improvements of 2 to 6 percent toward desired conditions in **alternatives B and D** are estimated due to treatments (mechanical and wildland fire) in riparian areas; while no reductions in departure from desired conditions are expected in **alternatives A and C** which lack riparian treatment objectives. Improvements to riparian areas under **alternatives A and C** would occur as opportunities arise and as a result of general vegetation and soil condition improvements in upland portions of watersheds.

Mechanical

Since **all alternatives** would have timber harvest and restoration treatment activities, there is the potential to adversely affect riparian habitats. Haul routes, skid trails, log landings, and stream crossings used to remove trees may impact riparian vegetation, soils, and stream function. In addition to erosion and sedimentation within the riparian area, these impacts can cause an effective extension of the channel network through the roads and skid trails connecting upstream disturbances to streams and can often overload the sediment filtering and storage ability of riparian areas.

These effects are typically limited in duration due to the closed roads being reclosed after the project and the natural rehabilitation of skid trails. Effectiveness monitoring and research have shown that proper implementation of BMPs and SWCPs (Forest Service Handbook 2209.23) greatly reduces erosion, compaction, displacement, and loss of soil structure by limiting heavy equipment access in riparian areas. Streamside management zones or vegetative filters would be prescribed for riparian areas minimizing impacts from all ground-disturbing activities as they are currently. The width of filter strips varies based on stream order, type, slope, erosion hazard of adjacent uplands, and the existing riparian area condition (Forest Service, 2008c).

Beneficial effects from mechanical treatments include removal of competing, non-riparian vegetation to allow for reestablishment of native riparian species, treatment of invasive species, and potential removal of unneeded roads within riparian corridors.

Wildland Fire

Wildland fire would be used as a management tool in **all alternatives**. Fire is a common disturbance in riparian ecosystems and surrounding hill slopes (Neary et al., 2005). Fire may lead to burning of surrounding uplands within the watershed resulting in higher sediment input, a higher degree of stream damage from increased peak flows, and a general decrease in basin stability (Neary et al., 2005). The magnitude of the effects of fire on riparian areas is primarily driven by fire intensity. As fire burns across the landscape, burn intensity is generally lower in riparian areas than surrounding upland vegetation because of the higher moisture content. High intensity wildfires can cause profound damage to plant cover and can indirectly increase streamflow velocity, sedimentation rates, and water temperatures, in contrast to low-intensity fires, which have less severe (severity) consequences.

BMPs are prescribed for all wildland fires and have been shown to be effective in reducing damage to riparian areas through the use of filter strips and implementation strategies. As an example, ignition techniques—such as mid-slope ignition—are used to protect riparian areas, allowing a lower intensity fire to burn downslope toward riparian areas and achieving other objectives upslope. Streamside management zones are also implemented for prescribed fire projects. The benefits for prescribed fire in riparian areas are similar to those listed for mechanical treatments.

Beneficial effects from wildland fire would include the removal of light competing, non-riparian vegetation to allow for reestablishment of native riparian species.

Motorized Routes

All alternatives address effects (listed below) from roads and motorized trails to riparian function to some degree. **All alternatives** provide standards and guidelines that reduce route impacts through BMPs and SWCPs. **All alternatives** strive to improve long term upland condition through forest restoration treatments, reducing the effects of high flows responsible for channel damage. **Alternatives B and D** provide an objective to decommission NFS roads or trails that reduce the area of productive lands, thus reducing road sediment and allowing channels to reoccupy the width necessary to reduce stream energy. The **action alternatives** also provide for restoration of priority watersheds, where concentrated efforts to inventory, rehabilitate, and relocate roads can make positive change in riparian function.

Generally, prior to the National Environmental Policy Act, roads were often located adjacent to water bodies and crossed them frequently. These traditional road location, design, construction, and maintenance activities have had considerable negative impacts on riparian areas across the forests; these impacts continue to some degree. Besides removal of productive riparian land to roadbed and ditches, some effects include the following (DeBano and Schmidt, 1989):

- Riparian areas are dewatered due to lowered channel bed nick points and gully formation, and they advance upstream from compaction and reduction of effective channel width.
- Plant composition is changed, with a shift from riparian dependent plants to drier and less productive upland species.
- Runoff is accelerated, causing increased flood peaks and related damages.
- Base flows are decreased in volume and duration, causing streams to dry up earlier in the year.
- Perennial streams are reduced to non-perennial flow.
- Channel bed and bank erosion is increased.
- Downstream sedimentation is increased from eroded soil.
- Habitat for riparian dependent wildlife species is reduced.

Recreation Activities

Common recreation activities within riparian areas include hiking, camping, fishing, swimming, biking, and motorized vehicle use. All of these activities can impact riparian condition by affecting vegetation and soils through soil compaction and displacement and destruction or damage to riparian vegetation. Off-highway vehicle use is limited in riparian areas to occasional crossing on approved roads and trails in **all alternatives**. In the **action alternatives**, there is guidance to locate dispersed campsites away from streams or sensitive areas, and facilities or developments could be provided for protection of the environment rather than for convenience of visitors. **Alternative A** does not contain this guidance and would allow campsites to be located in close proximity to the forests’ waters. This concentrated unmanaged recreation use could cause damage to vegetation, soil compaction and erosion, and water pollution from human and animal waste, dishwashing, trash, and vehicle fluids.

Grazing Activities

All alternatives would prescribe treatments that improve the vegetation conditions on uplands to more open conditions. By reducing tree canopy, there would be an increase in available forage for grazing animals. This would provide an opportunity for reduced grazing pressure on riparian areas from both domestic and wild animals. Many riparian areas are very resilient and respond quickly to removal or reduction of degrading factors such as overgrazing. Recovery of functioning-at-risk riparian areas could occur within the planning period of 15 years in

alternatives B and D if high treatment objective levels are implemented. Because there are no or few planned treatments to improve riparian conditions in **alternatives A and C**, there is less likelihood of recovering functioning-at-risk riparian areas.

Livestock (cattle and sheep) and wildlife grazing and browsing would continue in **all alternatives** and occur throughout many perennial streams, riparian areas, and some wetlands. Riparian and wetland areas have the capacity to produce forage in greater amounts and for longer periods than surrounding uplands due to increased moisture and deeper soils. For these reasons, these areas may attract concentrations of herbivores which can lead to detrimental overuse of the vegetation, thereby reducing long term forage productivity. Upland forests restored or maintained in open canopied conditions can also produce relatively more forage which can reduce grazing pressure on adjacent riparian and wetland areas.

All allotment management plans direct the use of best management practices (BMPs) and site-specific mitigation to reduce direct effects to riparian function, such as compaction from trampling or overutilization of forage. Currently, the forests do not permit livestock grazing on Federal lands along the mainstem portions of the Blue and San Francisco Rivers and Eagle Creek. Many other grazing allotments have limited livestock use along perennial streams and limited livestock access to hardened areas or to times when grazing pressure does not adversely affect riparian area condition.

The height and density of herbaceous vegetation in riparian areas is important for maintaining streambank stability needed for proper riparian condition and function. Areas of high concern are those with actively eroding stream banks or high erosion potential. Restoring native species in riparian areas is important to long term riparian condition. For example, Kentucky bluegrass and Canadian bluegrass have spread into many riparian areas as a result of widespread settlement and livestock management. These bluegrass species are far less productive than native grasses and willows and do not have root masses capable of withstanding streamflows required for streambank protection.

Special Uses

Water developments and road access are common special uses that affect riparian areas. In **all alternatives**, site-specific mitigations, BMPs, and maintenance requirements are written into each permit along with periodic monitoring to protect riparian areas.

Climate Change

Research predicts that as climate changes, water inputs are expected to decline (due to reduced precipitation); thereby reducing water in riparian zones. Water losses are also likely to increase due to elevated evapotranspiration rates at higher temperatures and greater runoff losses associated with increased frequencies of high intensity convectional storms. Urban expansion would increase human demand for water and further reduce water availability for ecosystems. Decreased water availability would affect riverine and riparian ecosystem function, due to modifications in geomorphological processes and an overall reduction in the availability of moisture to plant communities.

Although riparian areas compose less than 3 percent of Apache-Sitgreaves NFs lands, they provide important habitat for vertebrates, invertebrates, migratory birds, and other riparian-dependent species. Reduced water inputs would cause riparian ecosystems to contract in size.

Furthermore, lowered water availability would stress riparian plants and increase the ecosystem susceptibility to invasion by nonnative plants (e.g., salt cedar, Russian olive) which in turn would disrupt the natural wildlife community (Archer and Predick, 2008). Climate change is likely to alter wetland/cienega, fen, and bog ecosystems (Karl et al., 2009). Due to their ability to store and slowly release water, properly functioning wetlands/cienegas are imperative in periods of extreme droughts and may help mitigate the effects of climate change.

In light of the changes indicated above, there is a need to reduce vulnerability by maintaining and restoring resilient native ecosystems. Restoring and maintaining resilience in all ecosystems is part of the basic elements of forestwide desired conditions, and objectives and management approaches would be most provided for by **alternatives B, D, C, and then A,** respectively. Restoring and maintaining resilience would likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change related impacts and variability. Management practices such as thinning for age class diversity and structure and reclaiming and restoring native grasslands would help sustain healthy plant and animal communities. These practices would provide adequate nutrients, soil productivity, and hydrologic function to promote resilience and reduce opportunities for disturbance and damage.

Cumulative Environmental Consequences

Population growth impacts to riparian areas could increase, as demand for water and water-based recreation grows. Restriction of vehicles to roads and travel ways would reduce impacts to riparian areas compared to existing conditions, where few restrictions are in place. Urban demand for water may increase pressure on the Forest Service to reduce on-forest water use, although obtaining instream flow water rights on the forests' most valuable streams would help protect base flows to retain riparian function. Groundwater pumping is not regulated outside of Arizona's active management areas in southern and western Arizona. There are documented studies of effects of groundwater pumping on the Colorado Plateau that predict streamflow would be reduced which would affect water for riparian vegetation (Hart et al., 2002). Implementation of the **action alternatives** would be expected to slightly increase the long-term amount of water available for bank storage recharge and provide more water for aquifer recharge due to the expected reduction of upland vegetation transpiration and interception (Brewer, 2008; Baker et al., 1999). **Alternative A** would likely show only short-term gains in riparian improvement.

Fisheries

This section evaluates and discloses the potential environmental consequences to fish and their habitat on the Apache-Sitgreaves NFs through implementation of a new land management plan. Four alternatives are analyzed, which include the current forest plan (1987 plan) and three new alternatives. This section also provides a summary of the fish species viability assessment and the identification and descriptions of the endangered, threatened, and sensitive fish species and their occupied, critical, and recovery habitats that occur on the Apache-Sitgreaves NFs. Viability risks to fish species were determined by evaluating their abundance and distribution, current habitat conditions, and potential impacts to species populations and habitats from management actions that could occur within the planning area. For planning purposes, a viable population is defined as one which has the estimated numbers and distribution of reproductive individuals to ensure its continued existence is well distributed in the planning area. The term degraded means "a decline in the viability of ecosystem functions and processes" (Armantrout, 1998).

Affected Environment

Fish Species

There are presently 14 native fish species located throughout the Apache-Sitgreaves NFs (table 16). Seven of these native fish species are protected under the Endangered Species Act (ESA); 4 are listed as endangered and 3 are listed as threatened. The roundtail chub is a candidate species under the ESA and is also on the Southwestern Region Regional Forester's designated sensitive species list dated September 21, 2007; along with five other fish species also considered sensitive. The speckled dace is not federally listed or classified as sensitive. The razorback sucker was introduced into Eagle Creek and the Blue River in the 1980s; these introductions were not successful and the species is not currently present within or downstream of the Apache-Sitgreaves NFs, although designated critical habitat does occur in the Gila River approximately 7 to 15 miles south of the forests.

Table 16. Native fish species and their GIS miles of occupied, critical, and recovery habitat on Apache-Sitgreaves NFS lands

Species (Status)	Occupied Habitat	Critical Habitat	Recovery Habitat[a]
Apache trout (threatened)	31.6 miles	NA	81.9 miles
Gila chub (endangered)	9.3 miles[b]	32.8 miles	NA
Gila trout (threatened)	None	NA	33.5 miles
Loach minnow (endangered)	51.8 miles[b]	109.4 miles	NA
Razorback sucker (endangered)	None	None, downstream	NA
Roundtail chub (candidate/senstive)	45.2 miles	NA	NA
Spikedace (endangered)	Unknown	91.2 miles	NA
Little Colorado spinedace (threatened)	33.6 miles	7.1 miles	102.4 miles
Bluehead sucker (sensitive)	94 miles	NA	NA
Desert sucker (sensitive)	178 miles	NA	NA
Little Colorado River sucker (sensitive)	42.5 miles	NA	NA
Longfin dace (sensitive)	1,119 miles	NA	NA
Sonora sucker (sensitive)	156.1 miles	NA	NA
Speckled dace (NA)	378.9 miles	NA	NA

[a] Habitat that has been identified as necessary for recovery/restoration of the species.

[b] Occupied habitat miles for these species spatially overlap with critical habitat miles.

Along with the native fish species, there are 24 nonnative fish species occurring on the Apache-Sitgreaves NFs. Several of these species are cold water fish that generally do not occur below 6,500 feet in elevation, especially the trout species. Most are warm water centrarchid (sunfish family) and cyprinid (minnow family) species that occur below 8,000 feet in elevation.

Following is a list of nonnative fish species that occur within the forests:

Black Bullhead	Western mosquitofish	Common Carp
Channel Catfish	Bluegill	Smallmouth Bass
Golden Shiner	Rainbow Trout	Fathead Minnow
Black Crappie	Brown Trout	Walleye
Goldfish	Red Shiner	Northern Pike
Green Sunfish	Redear Sunfish	Largemouth Bass
Cutthroat Trout	Yellow Perch	White Crappie
Flathead Catfish	Brook Trout	Arctic Grayling

Native Fish Population, Distribution, and Habitat

The Apache-Sitgreaves NFs historically provided habitat for 14 native fish species, from high elevation cold water trout streams to lower elevation warm water streams with primarily cyprinid species. Together, these 14 species occur in approximately 477 miles (63 percent) of the 763 miles of perennial streams on the forests (Vander Lee et al., 2006).

Aquatic and riparian habitat on the Apache-Sitgreaves NFs is extremely limited (less than 3 percent of the forests) but provides for a wide array of aquatic biota and terrestrial flora and fauna. These habitats are critical to sustaining aquatic biota diversity in the Southwest. Overall, the Apache-Sitgreaves NFs account for 41 percent of the perennial streams and 38 percent of the stream reaches with native fish on national forests in Arizona (Vander Lee et al., 2006).

The speckled dace, Sonora sucker, and desert sucker have the largest distributions on the Apache-Sitgreaves NFs; while the Gila trout, Gila chub, and spikedace have the smallest. All of the streams with loach minnow on national forests in Arizona are on the Apache-Sitgreaves NFs. In addition, within national forests in Arizona, over two-thirds of the stream reaches with the bluehead sucker (95 percent), Apache trout (80 percent), Gila trout (71 percent), Little Colorado sucker (70 percent), and Little Colorado spinedace (66 percent) are on the Apache-Sitgreaves NFs (Vander Lee et al., 2006).

Current information regarding aquatic and riparian habitats and aquatic biota primarily consists of surveys and studies completed by State and Federal agencies over the last 10 to 20 years. These surveys show that approximately 70 percent of the surveyed stream reaches are not meeting a minimum habitat condition index (HCI) standard of 60 percent[18]. Where repeat surveys have

[18] The 1987 plan provides management emphasis and monitoring for fish species and riparian habitat using the habitat condition index (HCI) and biologic condition index (BCI) for aquatic macroinvertebrates. The HCI is a multivariate rating of existing habitat conditions based on several factors: pool frequency and occurrence; substrate conditions and types; and streambank cover, soil, and vegetation stability. The HCI evaluates the stream’s existing habitat conditions relative to its potential. The BCI incorporates stream habitat, water quality, and environmental tolerances of aquatic macroinvertebrate community species. The BCI is a function of a Predicted Community Tolerance Quotient divided by the Actual Community Tolerance Quotient and evaluates a stream’s condition in relation to its own potential. As required in the 1987 plan, minimum conditions (values) for the HCI should be 60 percent and 80 percent for the BCI.

occurred, HCI ratings on approximately 50 percent of those stream reaches have declined over the last 20 years, while HCI ratings have increased on the other 50 percent.

Fish population surveys and sampling efforts have also shown declines for many species over the last 20 years. According to Robinson et al. (2006), most of Arizona's stream length was assessed to be in the "most disturbed"[19] ecological condition; 70 percent was in most disturbed condition based on the aquatic vertebrate index of biotic integrity (IBI) and 57 percent was in most disturbed based on a macroinvertebrate IBI.

Most streams and aquatic and riparian habitats have experienced considerable degradation and alteration from a variety of human and management related activities; their ability to recover and improve has been affected, especially as ongoing and new impacts occur. Habitat quality and complexity changes have resulted from loss of pool habitat, loss of large wood within streams, riparian area impacts, channel alterations, and down cutting. Increased sedimentation rates can adversely impact habitat and species through negative impacts to water quantity and quality. Fish population surveys and sampling efforts have also shown declines for some species, while some nonnative species have shown increases.

Historic activities (e.g., grazing, water developments and diversions, timber harvest and roads, fire suppression) that occurred 20 to over 100 years ago caused impacts to aquatic communities and their watersheds. The species and habitats of today have not yet recovered. Fish populations have been reduced from large interconnected populations to isolated populations within severely altered and degraded habitats. All native species have lost much of their population redundancy[20] within and outside the forests. This is reflected in the historic and recent (last 20 years) population declines and fragmentation of fish species on the Apache-Sitgreaves NFs (Forest Service, 2008e). Historically, 17 of the 33 5th level HUC watersheds on the forests contained one or more fish species. Currently, only 12 of these watersheds contain native fish; those that still contain native fish have lost one to several species. There are two watersheds (Coyote Creek and Oso Draw) on the forests where no fish were historically present, but are currently occupied by Apache trout (table 17).

[19] Most disturbed ecological condition for macroinvertebrates is defined as having lost more than 50 percent of the expected taxa (species naming hierarchy). For native aquatic vertebrates and habitat, it is the 5 percent most divergent relative to the reference condition.

[20] Redundancy means having several distinct populations of a species, so that if some catastrophic event killed one population, the species would not become extinct.

Table 17. Current and historical occurrences of native fish species by 4th and 5th level hydrologic unit code (HUC)

4th Level HUC Name	5th Level HUC Name	Longfin dace	Sonora sucker	Gila chub	Roundtail chub	Spinedace/ Spikedace	Apache trout	Gila trout	Desert sucker	Bluehead sucker	Speckled dace	Loach minnow	Little Colorado River Sucker	Razorback sucker	Historic	Current
Little Colorado River Headwaters	Nutrioso Creek				H[1]	C[2]	H			C	C				5	3
	South Fork Little Colorado River-Little Colorado River Headwaters					H	C			C	C		H		5	3
	Coyote Creek						C[3]									1
	Carnero Creek-Little Colorado River Headwaters															0
Upper Little Colorado River	Big Hollow Wash															0
	Oso Draw						C[3]									1
Silver Creek	Show Low Creek		H		H	H					H		H		5	0
	Upper Silver Creek					H				H	H	H			4	0
	Cottonwood Creek		H		H	H					H				4	0
Middle Little Colorado River	Phoenix Park Wash-Dry Lake															0
	Upper Clear Creek				H	H				C	C		C		5	3
	Lower Clear Creek				H	H				C	C		C		5	3

4th Level HUC Name	5th Level HUC Name	Longfin dace	Sonora sucker	Gila chub	Roundtail chub	Spinedace/ Spikedace	Apache trout	Gila trout	Desert sucker	Bluehead sucker	Speckled dace	Loach minnow	Little Colorado River Sucker	Razorback sucker	Historic	Current
Chevelon Canyon	Upper Chevelon Canyon				H	H				C	C		C		5	3
	Black Canyon				H					H	H				3	0
	Lower Chevelon Canyon				H	H				H	H		C		5	1
Mangus Creek-Upper Gila River	Apache Creek-Upper Gila River															0
San Francisco River	Centerfire Creek-San Francisco River	H	H						H		H				4	0
	Upper Blue River	C	C	H	H		C	C	C		C	C			9	7
	Pueblo Creek-San Francisco River															0
	Lower Blue River	C	C	H	H	H			C		C	C		H	9	5
	Mule Creek-San Francisco River	C	C	C	H	H			C		C	H		H	9	5
	Chase Creek-San Francisco River	C	C	H	H	H			C		C	H		H	9	4
Upper Gila River – San Carlos Reservoir	Willow Creek															0

4th Level HUC Name	5th Level HUC Name	Longfin dace	Sonora sucker	Gila chub	Roundtail chub	Spinedace/ Spikedace	Apache trout	Gila trout	Desert sucker	Bluehead sucker	Speckled dace	Loach minnow	Little Colorado River Sucker	Razorback sucker	Historic	Current
	Upper Eagle Creek	C	C	C	C	C		H	C		C	C		H	10	8
	Lower Eagle Creek	C	C	H	H	H			C		C	H		H	9	4
Black River	Upper Black River		C		C		C		C		C	C				6
	Middle Black River		C		C		C		C		C					5
White River	Upper North Fork White River															0
	East Fork White River															0
Upper Salt River	Canyon Creek															0
Carrizo Creek	Corduroy Creek															0
	Carrizo Creek (local drainage)															0
Tonto Creek	Haigler Creek-Tonto Creek															0

H[1] = historic occurrence only, no current occurrences of this fish species
C = current occurrence of this fish species
C[2] = current and historic occurrence of this fish species
C[3] = current occurrence where there was no historic occurrence of this fish species

The native fish species and populations analyzed here (especially federally listed) lack the resiliency to survive environmental disturbances from either natural or anthropogenic actions (e.g., fire and suppression of fire, climate variation, degraded watersheds and aquatic habitat, altered hydrologic conditions, loss of riparian and aquatic habitat, recreation demands, nonnative species introductions, roads). The watersheds and ecosystems that these aquatic species and their habitats depend on are also altered and departed from historical conditions. While most of these impacts have occurred slowly over many decades, the individual and collective impacts still remain. Current conditions for fisheries at the 5th level HUC watershed can be attributed to many factors. Changes throughout vegetation types have altered fire regimes, successional structure, composition and cover classes, and processes from historic conditions. Several vegetation types also have impaired soil conditions. Additionally, riparian condition is predominantly functioning-at-risk and hydrologic conditions (e.g., groundwater, water quality, streamflow) have also changed from historic conditions. See the “Vegetation,” “Soil,” “Water Resources,” and “Riparian” sections for more information.

The razorback sucker has not been found on the forests since the late 1980s and the spikedace has not been found recently. Although razorback sucker is considered extirpated (locally extinct) at this time, the spikedace is not. Spinedace, spikedace, and loach minnow are likely declining range-wide. The roundtail chub, Little Colorado sucker, and the bluehead sucker have recently been included within a multistate conservation agreement in an attempt to improve their status and potentially prevent them from future listing under the ESA. The longfin dace, Sonora sucker, desert sucker, and speckled dace are also likely declining in their numbers and/or distributions across the Apache-Sitgreaves NFs. Recent declines for the speckled dace are associated with chemical treatments of streams for Apache trout recovery projects. Although this has likely impacted large numbers of individuals and reduced distribution, no populations have been lost and the species is considered secure within the planning area.

Endangered and Threatened Species and Critical Habitat

Apache Trout (*Oncorhynchus apache*)

The life history, ecology, historical distributions and abundances, habitat requirements, and other information relevant to this species are limited; data and information collection has primarily occurred on White Mountain Apache Tribal lands. Some of this information has been summarized and reviewed within the three Apache trout recovery plans, the first version completed in 1979 and the latest in 2009. Recovery efforts for this species began as early as the 1940s on White Mountain Apache Tribal lands and later on NFS lands in the 1960s. Over the last 5 to 10 years, the Arizona Game and Fish Department (AZGFD), with assistance from the Apache-Sitgreaves NFs, has expended considerable efforts on recovery actions to improve the species status. These have primarily included barrier construction and maintenance, chemical treatments to remove nonnative fish, and the subsequent introductions of Apache trout. Despite these efforts, recovery of populations has been very limited due to barrier and chemical treatment efficacy and the genetic purity and availability of Apache trout to place into historical habitats on the forests.

The historical distribution of Apache trout has been somewhat confused with that of Gila trout. Originally, Apache trout were thought to have historically occurred and occupied the headwaters of the Little Colorado, Salt, and San Francisco Rivers. The more recent view is that the headwaters of the San Francisco River were historically occupied by Gila trout. Regardless, the former widespread distribution of Apache trout in the Black, White, and Little Colorado drainages is not disputed based on historical and more recent documented collections. The San Francisco River headwaters are now considered within historic range of Gila trout, although some Apache trout populations are still present from past recovery actions (i.e., Coleman, Grant, and KP Creeks).

Existing and potential Apache trout recovery populations occur on the forests and White Mountain Apache Tribal lands in Arizona within the historic range of the species. Outside of their historic range, several introduced populations occur on the Coronado NF and one occurs on the Kaibab NF. Existing and recovery populations on the forests included in this analysis are Bear Wallow Creek, Centerfire/Boggy/Wildcat Creeks, Coleman Creek, Conklin Creek, Coyote/Mamie Creeks, East Fork Little Colorado River (and Lee Valley Creek), Fish Creek, Grant Creek, Hannagan Creek, Hayground Creek, Home Creek, KP Creek, Mineral Creek, Snake Creek, Soldier Creek, South Fork Little Colorado River, Stinky Creek, West Fork Black River, and West Fork Little Colorado River.

The Apache trout was listed as threatened with extinction under the Endangered Species Preservation Act of 1966. A final rule was issued in the Federal Register on July 16, 1975, that determined the Apache trout is a threatened species as defined by the Endangered Species Act of 1973. The reasons for listing and threats to the species can be found in the three versions of the recovery plans, and the final rule “Threatened Status for Three Species of Trout” (40 FR 29863) published in the Federal Register in 1975. Threats to the species include the destruction, modification, and curtailment of its habitat or range; logging operations and the associated erosion, siltation, and increases in water temperatures; and the introduction of nonnative trout species that hybridize and compete with the Apache trout.

Gila Chub (*Gila intermedia*) and Critical Habitat

Life history, ecology, historical distributions and abundances, habitat requirements, and other information relevant to this species are limited; data and information collection has primarily occurred on populations outside the Apache-Sitgreaves NFs. Most of the available information for this species has been summarized and reviewed within the proposed and final rules for the “Listing Gila Chub as Endangered with Critical Habitat” completed in 2002 and in 2005, respectively. This species is found in pools in smaller streams and cienegas ranging in elevation from approximately 600 to 1,675 meters (2,000 to 5,500 feet). They are highly secretive; adults prefer deeper water in pools and eddies below riffles or runs, often remaining in cover from terrestrial vegetation, boulders, and fallen logs. Young use the shallow pool margins with aquatic vegetation or debris for cover, while older juveniles may be found in higher velocity runs and riffles. Primary food items are aquatic and terrestrial insects and filamentous algae. Breeding primarily occurs in late spring to summer, males follow the larger females over beds of aquatic plants; there is no parental care of the young. Temperature may be the primary cue for initiation of spawning.

Gila chub potentially occur within six streams on the Apache-Sitgreaves NFs: Eagle Creek, East Eagle Creek, Dix Creek, Left Prong Dix Creek, Right Prong Dix Creek, and Harden Cienega Creek. These six streams are considered to be three distinct populations: Dix Creek, Eagle/East Eagle Creek, and Harden Cienega Creek. The Eagle/East Eagle Creek population is located within the upper portion of this watershed; Eagle Creek flows through the Apache-Sitgreaves NFs before entering the Gila River approximately 15 miles downstream of the Apache-Sitgreaves NFs’ boundary. Dix Creek and Harden Cienega Creek are located south of the San Francisco

River; both flow north into the San Francisco River. The Dix Creek watershed is entirely within the Apache-Sitgreaves NFs, while the upper portion of the Harden Cienega watershed is located in New Mexico on the Gila NF.

Gila chub was listed with critical habitat by the U.S. Fish and Wildlife Service as endangered in 2005. Gila chub are becoming rare, especially where land use practices such as overgrazing lead to incision of floodplains and lowering of water tables, which, in turn, drain marshlands and other stream-associated habitats. Threats to the chub include introduced nonnative aquatic competitors and predators (e.g., fish, bullfrogs, crayfish), continued water use for development purposes, and habitat degradation due to improper land management on the watershed. Erosion from roads or off bare ground on the watersheds can fill in the deep pools needed by the species, thus degrading the habitat. Where it is still present, populations are often small, fragmented, and at risk from known and potential threats and from random events such as drought, flood events, and wildfire.

Critical habitat was designated for the Gila chub on November 2, 2005. Critical habitat on the Apache-Sitgreaves NFs was designated in six streams for the three separate populations as follows:

- Eagle Creek and East Eagle Creek for 39.2 kilometers (24.4 miles) of creek extending from the confluence of Eagle Creek with an unnamed tributary upstream to its confluence with East Eagle Creek, and including East Eagle Creek to its headwaters just south of Highway 191.
- Harden Cienega Creek for 22.6 kilometers (14 miles), beginning from its confluence with the San Francisco River and continuing upstream to its headwaters. Approximately 65 percent (9 miles) is located on the Apache-Sitgreaves NFs.
- The Dix Creek critical habitat includes the portion of the creek beginning 1 mile upstream from the confluence with the San Francisco River at a natural rock barrier and continuing upstream for 0.9 kilometers (0.6 mile) to the confluence of the right and left forks of Dix Creek. The critical habitat also includes the Left Prong Dix Creek as it continues upstream 2 kilometers (1.2 miles) and the Right Prong Dix Creek as it continues upstream 4.8 kilometers (3 miles).

Gila Trout (*Oncorhynchus gilae*)

Life history, ecology, historical distributions and abundances, habitat requirements, and other information relevant to this species are limited; data and information collection has primarily occurred on the Gila NF in New Mexico. Some of this information has been summarized and reviewed in the four Gila trout recovery plans; the first version completed in 1979 and the latest in 2003. Over the last 5 to 10 years, the AZGFD and Apache-Sitgreaves NFs have implemented some recovery actions to improve the species status on the Apache-Sitgreaves NFs, although most efforts have been focused on Apache trout recovery.

The historical distribution of Gila trout has been somewhat confused with that of Apache trout. Originally Apache trout were thought to have historically occurred and occupied the headwaters of the Little Colorado, Salt, and San Francisco Rivers. The more recent view is that the headwaters of the San Francisco River were historically occupied by the Gila trout. The San Francisco River headwaters are now considered within historic range of Gila trout, although some Apache trout populations are still present from past recovery actions (i.e., Coleman, Grant, and KP Creeks).

Existing and potential Gila trout recovery populations occur on the Apache-Sitgreaves NFs within the Blue River and Eagle Creek drainages. Existing and recovery populations on the Apache-Sitgreaves NFs included in this analysis are Castle/Buckalou Creeks, Chitty Creek, Grant Creek, KP Creek, Lanphier Creek, McKittrick Creek, and Raspberry Creek.

The Gila trout was listed as threatened with extinction under the Endangered Species Preservation Act of 1966. The reasons for listing and threats to the species can be found within the four versions of the recovery plans and the final rule "Reclassification of the Gila Trout From Endangered to Threatened; Special Rule for Gila Trout in New Mexico and Arizona" (71 FR 40657) published in the Federal Register in 2006. Threats to the species include the destruction, modification, and curtailment of its habitat or range; livestock grazing; fire; timber harvest operations and the associated erosion, siltation, and increases in water temperatures; and the introduction of nonnative trout species that hybridize and compete with Gila trout.

The most recent version of the recovery plan identified eight candidate streams on the Apache-Sitgreaves NFs for potential Gila trout introduction. These include one stream within the Eagle Creek drainage (Chitty Creek) and seven streams within the Blue River drainage (Castle/Buckalou Creek, Coleman Creek, Grant Creek, KP Creek, Lanphier Creek, McKittrick Creek, and Raspberry Creek). Some streams are also currently occupied by hybridized Apache trout; Raspberry Creek is the only stream that could potentially have Gila trout present because they were introduced into this stream in 2000. The eight populations being considered here cover approximately 51,686 acres and 25 miles of streams. The AZGFD surveyed a portion of Raspberry Creek in 2006; five fish were observed and three were captured in electrofishing efforts. The current status is unknown, but if Gila trout have persisted, it is likely their numbers are very low.

Little Colorado Spinedace (*Lepidomeda vittata*) and Critical Habitat

The natural history of Little Colorado spinedace can be found in the "Little Colorado River Spinedace Recovery Plan," and the "Final Rule to Determine *Lepidomeda vittata* (Little Colorado Spinedace) to be a Threatened Species with Critical Habitat" (52 FR 35034). The Little Colorado spinedace is a member of the Cyprinidae family and is typically less than 10 cm long. This species is predacious, feeding on aquatic and terrestrial insects, as well as filamentous algae. This species inhabits medium to small streams and is characteristically found in pools with water flowing over fine gravel and silt-mud substrates. Many of the streams are seasonally intermittent, at which times the Little Colorado spinedace persists in the deep pools that retain water. During flooding, the spinedace redistributes itself throughout the stream. Spawning primarily occurs in early summer, but some spawning continues until early fall. Typical habitat ranges in elevation from 4,000 to 8,000 feet.

Most of the existing and potential Little Colorado spinedace recovery streams or populations occur on and downstream of the Apache-Sitgreaves NFs and the Coconino NF. Existing populations on the Apache-Sitgreaves NFs are within Nutrioso Creek and one of its tributaries, Rudd Creek. On July 23, 2007, 95 fish were introduced into West Chevelon Creek. Potential recovery streams on the Apache-Sitgreaves NFs include Chevelon Creek and Willow Creek (and its tributaries). Leonard Canyon is the boundary between the Apache-Sitgreaves NFs and the Coconino NF and is currently occupied by Little Colorado spinedace. Critical habitat occurs on the Springerville Ranger District within the lower 5 miles of Nutrioso Creek from Nelson

Reservoir Dam downstream to the forests' boundary. Primary constituent elements for critical habitat include clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate.

Past threats and declines of this species resulted from habitat alterations and loss due to impoundment, removal of water from streams, channelization, grazing, road building, urban growth, and other human activity. Their decline is also related to the introduction and spread of nonnative predatory and competitive fish species and the use of pesticides (ichthyotoxins) in many of its native streams. Current threats to the species' survival include changes in streamflow patterns, declines in water quality and quantity, modifications of watersheds (logging, dams, road construction), manipulations of fish populations (use of chemicals and other factors), and interactions with introduced fishes and other aquatic species.

Existing and potential recovery populations of Little Colorado spinedace occur in Chevelon Creek, Leonard Canyon, Nutrioso Creek, Rudd Creek, West Chevelon Creek, and Willow Creek on the Apache-Sitgreaves NFs; all except Chevelon and Willow Creeks are currently occupied by the species. All of these streams are contained in three watersheds (Nutrioso Creek, Chevelon Creek, and East Clear Creek) that drain into the Little Colorado River. Recent impacts to the species are due to drought, nonnative species, and alteration of natural hydrographs in occupied habitat. Livestock and wild ungulate grazing have also been identified as contributing to poor watershed conditions which exacerbate the effects of drought and result in diminished habitat quality. Fuels reduction, forest restoration projects, and fire management actions have also contributed to altered hydrographs and sediment loads in streams occupied by Little Colorado spinedace.

Loach Minnow (*Tiaroga cobitis*) and Critical Habitat

Loach minnows are found in turbulent, rocky riffles of rivers and tributaries from approximately 2,300 to 8,000 feet in elevation. Loach minnow are bottom-dwelling inhabitants of shallow, swift waters flowing over gravel and cobble substrates in mainstream rivers and tributaries. They use the spaces between and the protective shelter of larger substrates for resting and spawning. The species is rare or absent from habitats where fine sediments fill the spaces between larger substrate. Loach minnow generally first spawn in their second year, primarily from March through May; they may also spawn in the fall. Spawning occurs in the same riffles occupied by adults during the non-spawning season. The adhesive eggs are attached under the downstream side of a rock that forms the roof of a small cavity in the substrate. Longevity is typically 15 months to 2 years, although loach minnow can live as long as 3 years. Loach minnow feed exclusively on aquatic insects and are opportunistic bottom-feeding insectivores, feeding primarily on riffle-dwelling larval mayflies and midges. They actively seek their food on bottom substrates, rather than pursuing food items in the drift.

The loach minnow is endemic to the Gila River basin of Arizona and New Mexico and Sonora, Mexico. Its historic range included the basins of the Verde, Salt, San Pedro, San Francisco, and Gila Rivers. During the last century, both the distribution and abundance of the loach minnow have been greatly reduced throughout its range. Extant populations are geographically isolated and inhabit the upstream reaches of their historic range. Historically in Arizona, the loach minnow occupied up to 1,400 miles of streams, but it is now found in less than 140 miles. The loach minnow is generally rare to uncommon where it is found in the following areas: Aravaipa Creek (Pinal and Graham Counties), limited reaches of the White River (Gila County) and the North and East Forks of the White River (Navajo County), Three Forks area of the East Fork

Black River, throughout the Blue River, Campbell Blue Creek, Eagle Creek, and the San Francisco River between Clifton and the New Mexico border.

The loach minnow is currently listed as an endangered species. On February 23, 2012, a final rule was published by the U.S. Fish and Wildlife Service to change the status to endangered and designate critical habitat for both spikedace and loach minnow. During the last century, the distribution and abundance of loach minnow have been greatly reduced throughout the species range. Competition and predation by nonnative fish and habitat destruction have reduced the historic range of the loach minnow by about 85 percent. Both historic and present landscapes surrounding loach minnow habitats have been impacted to varying degrees by domestic livestock grazing, mining, agriculture, timber harvest, recreation, development, and impoundments. These activities degrade loach minnow habitats by altering flow regimes, increasing watershed and channel erosion and, thus, sedimentation, and adding contaminants to streams and rivers. These activities may affect loach minnow through direct mortality, interference with reproduction, and reduction of invertebrate food supplies.

All the populations listed above are experiencing low abundance which can be attributed to many factors. Recent surveys (last 5 to 20 years) have not documented the species' presence in the East Fork Black River, Eagle Creek, or the San Francisco River populations; although the U.S. Fish and Wildlife Service consider the populations to still exist. Recent surveys on the Blue River have documented the continued presence of this species; this population is likely more stable than others on the Apache-Sitgreaves NFs.

Approximately 110 miles of critical habitat was designated for loach minnow in the Blue River (45.3 miles), Campbell Blue Creek (6 miles), Little Blue Creek (3.1 miles), Eagle Creek (12.1 miles), East Fork Black River (11.9 miles), North Fork East Fork Black River (4.4 miles), Boneyard Creek (1.4 miles), Coyote Creek (2.1 miles), and the San Francisco River (23.7 miles) within the Apache-Sitgreaves NFs.

Razorback Sucker (*Xyrauchen texanus*) and Critical Habitat

The razorback sucker, also known as the humpback sucker, is a member of the Catostomidae family. The species can grow more than 600 mm (2 feet) in length, weigh more than 3 kg (6 pounds), and live over 40 years. Examination of stomach contents of adult razorback suckers from Lake Mohave indicates that the species is a bottom feeder, whose diet includes planktonic crustaceans, diatoms, filamentous algae, and detritus. Spawning occurs in the lower Colorado River basin from January through April; in the upper basin, observation indicates that spawning occurs from late April through mid-June. Spawning occurs over mixed substrates that range from silt to cobble and at water temperatures ranging from 10.5 to 21 ºC (51 to 70 ºF). Razorback sucker inhabit riverine systems which provide a wide variety of habitats including backwaters, sloughs, oxbow lakes, and seasonally inundated floodplains, which are used to satisfy various life history requirements. Adult razorback suckers prefer shallow and swift waters of mid-channel sandbars (less than 12 feet in depth) during the summer months and slow runs, slack waters, and eddies in the winter. The "Razorback Sucker Recovery Plan" (USFWS, 1998) describes the life history and habitat use of this species in detail.

Detailed information relative to the distribution and abundance of razorback sucker can be found in the recovery plan. Razorback suckers are listed as occurring in the Verde and Salt Rivers with designated critical habitat in both systems. Razorback suckers have been regularly stocked in the

Verde River since the 1980s. The Salt River subbasin has not been stocked since the early 1990s. Surveys do detect the species in the Verde River. However, a viable population is not thought to exist. It is likely that the razorback sucker is not currently present in the Salt River subbasin of the Gila River Basin. Razorback suckers are thought to no longer occur in Eagle Creek and the Blue River on the Apache-Sitgreaves NFs. These populations were stocked during the 1980s; surveys conducted since stocking have failed to detect the species.

Fifteen river reaches covering about 49 percent of the historic razorback sucker habitat (2,775 km; 1,724 miles) are designated critical habitat within the Colorado River Basin. The Gila River from the Arizona-New Mexico state line to Coolidge Dam is included in this designation. After leaving the Apache-Sitgreaves NFs, both Eagle Creek and the San Francisco River enter this portion of critical habitat, approximately 15 to 20 miles downstream of the Apache-Sitgreaves NFs boundary. Three primary constituent elements have been identified for razorback sucker critical habitat: water, physical habitat, and the biological environment. The water element includes consideration of water quality and quantity. Water quality is defined by parameters such as temperature, dissolved oxygen, environmental contaminants, nutrients, turbidity, and others. Water quantity refers to the amount of water that must reach specific locations at a given time of year to maintain biological processes and to support the various life stages of the species. The physical habitat elements include areas of the Colorado River system that are or could be suitable habitat for spawning, nursery, rearing, and feeding, as well as corridors between such areas.

Decline of the razorback sucker has been associated with major changes in its riverine ecosystem including water diversion, water depletion, and construction and operation of dams. The species decline is also attributed to predation by green sunfish, warmouth, channel catfish, flathead catfish, threadfin shad, smallmouth bass, and largemouth bass.

Razorback suckers were introduced into Eagle Creek and the Blue River on the Apache-Sitgreaves NFs in the 1980s. There are no historical records of this species occurring in either of these streams, although it is more likely they would have occurred historically in the San Francisco River on the Apache-Sitgreaves NFs. From 1983 through 1989, 335,506 razorback suckers were introduced into Eagle Creek within and downstream of the Apache-Sitgreaves NFs. Between 1986 and 1989, 167,457 razorback suckers were introduced into the Blue River on the Apache-Sitgreaves NFs. Only 5 to 10 individuals were ever recaptured, and these recaptures occurred within the stocking years of 1983 to 1989. The fate of these fish is unknown, but they are no longer considered to be present in either stream on or downstream of the Apache-Sitgreaves NFs boundary.

Spikedace (*Meda fulgida*) and Critical Habitat

Adult spikedace are 2.5 to 3 inches long, the eyes are large, the snout fairly pointed, and the mouth is slightly subterminal with no barbells present. The species is slender and somewhat anteriorly compressed. Spikedace can live up to 24 months, although few survive more than 13 months; reproduction occurs primarily in 1-year-old fish. Spawning occurs mid-March into June in shallow riffles with gravel and sand bottoms and moderate flow. By mid-May, most spawning has occurred, although in years of high water flows, spawning may continue into late May or early June. Spikedace feed primarily on aquatic and terrestrial insects.

Spikedace occupy mid-water habitats usually less than 3 feet deep, with slow to moderate water velocities over sand, gravel, or cobble substrates. Adults often occur in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars. The preferred habitat of the spikedace varies seasonally and with maturation. In winter, the species congregates along stream margins with cobble substrates. The erratic flow patterns of southwestern streams, including periodic and recurrent flooding, are essential to the feeding and reproduction of the spikedace by scouring the fine sediment and keeping gravels clean. Spikedace larvae and juveniles tend to occupy shallow, peripheral portions of streams that have slow currents and sand or fine gravel substrates, but also occupy backwater habitats.

The spikedace is native to the Gila River drainage, including the San Francisco drainage, except in the extreme headwaters. The spikedace currently persists only in the upper Verde River and Aravaipa Creek in Arizona and portions of the Gila River in New Mexico; spikedace have not been collected in the Verde River in recent years. In New Mexico the species is generally absent from the Gila River from the confluence of the West and East Forks downstream to the mouth of Turkey Creek, and occurs irregularly downstream from the mouth of the Middle Box of the Gila River to the Arizona-New Mexico state line.

The majority of historic spikedace habitat has been drastically altered or destroyed by human uses of the rivers, streams, and watersheds. Causes of such alterations and degradation include damming, water diversion, channel downcutting, excessive groundwater pumping, lowering water tables, channelization, riparian vegetation destruction, erosion, mining, grazing, and other watershed disturbances. An increasing threat to spikedace includes the introduction and spread of nonnative species that compete or predate upon spikedace.

Resource activities that affect water quality (e.g., removal of riparian vegetation, sedimentation, control of water levels) can affect spikedace habitat quality. All of these activities have impacted the Apache-Sitgreaves NFs to varying degrees. The only documentation of spikedace on the Apache-Sitgreaves NFs has been in Eagle Creek; although it is likely historical habitat could have been in the San Francisco River. The species is still considered to be present within Eagle Creek, even though it has not been collected for over 20 years.

Critical habitat for spikedace was published in the Final Rule (77 FR 10810) on February 23, 2012; designates approximately 90 miles of streams including the Blue River (45.3 miles), Campbell Blue Creek (6 miles), Little Blue Creek (3.1 miles), Eagle Creek (12.1 miles), and the San Francisco River (23.7 miles) on the Apache-Sitgreaves NFs.

Sensitive Species

Roundtail Chub

Roundtail chub utilize slow moving, deep pools for cover and feeding. They are found in the main stems of major rivers and smaller tributary streams. Roundtail chub utilize a variety of substrate types (silt, sand, gravel, and rocks) and prefer murky water. Habitat use varies by life stages (adult, juvenile, and young-of-year). Juveniles and young-of-year are found in quiet water near the shore or backwaters with low velocity and frequent pools rather than glides and riffles. Juveniles use instream boulders for cover, while young-of-year are found in gaps between and under boulders or the slack-water area behind boulders. Adults generally do not frequent vegetation and avoid shallow water cover types, such as overhanging and shoreline vegetation. Adults are found in eddies and pools adjacent to strong current and use instream boulders as cover. Roundtail chub are carnivorous and opportunistic feeders; food items include aquatic and terrestrial insects, fish, snails, crustaceans, and algae.

Threats to roundtail chub include habitat alteration and degradation from water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, livestock grazing, and predation and competition by nonnative aquatic species. Only three populations are found on the Apache-Sitgreaves NFs: lower Chevelon Creek, Black River, and Eagle Creek. Although the historical distribution and reference conditions for this species on the Apache-Sitgreaves NFs are unknown, it is likely that the approximately 40 miles of occupied habitat for this species has been reduced. Trends in population and habitat for roundtail chub on the Apache-Sitgreaves NFs have decreased from historical levels; primarily resulting from reduction in habitat quantity and quality, along with establishment of nonnative aquatic species.

Bluehead, Desert, Little Colorado River, and Sonora Suckers

Bluehead suckers tend to utilize swifter velocity, higher gradient streams than those occupied by Little Colorado River suckers. They are found in warm to cool streams with rocky substrates; habitat use varies by life state. Larval and juvenile fish inhabit near-shore, low velocity habitats, and as they mature, they move to deeper habitats further from shore and with more cover. The Little Colorado River sucker occurs primarily in pools with abundant cover. Both of these sucker species occur within the upper Little Colorado River watershed; their ranges and occurrences often overlap. For the bluehead sucker, approximately 80 miles of occupied habitat occurs on the Apache-Sitgreaves NFs; streams include Chevelon Creek, Leonard Canyon, Little Colorado River, Nutrioso Creek, and Willow Creek. The Little Colorado River suckers occupied habitat is approximately half that of the bluehead sucker (approximately 40 miles); streams occupied are Chevelon Creek and Leonard Canyon. Desert suckers are found in rapids and pools, primarily over areas of gravel-cobble with sand-silt in between the larger substrate and elevations range from approximately 500 to 8,500 feet. They occur within numerous streams within the planning area (168 miles) and are found throughout the Black River, Eagle Creek, Blue River, San Francisco River, and their tributaries. Sonora suckers are found in a variety of habitats from warm rivers to higher elevation trout streams between 1,500 and 8,750 feet. They also occur throughout the planning area in the same streams as the desert sucker, with a somewhat reduced distribution of approximately 148 miles. Threats to these species and their habitats include the alteration and destruction of habitat from anthropogenic and management activities and the introduction and establishment of nonnative aquatic species.

Longfin Dace

The distribution and habitat of longfin dace is wide ranging, from intermittent, hot, low desert streams to clear and cold streams at higher elevations. They tend to occupy relatively small to medium size streams with sand or gravel bottoms and eddies and pools near overhanging banks or other cover. They are rarely abundant in large streams or above 5,000 feet elevation. They are generally found in water less than 75 °F, but are tolerant of high temperatures and low dissolved oxygen. Occupied habitat on the Apache-Sitgreaves NFs is approximately 105 miles including Eagle Creek, San Francisco River and several tributaries, and the Blue River and numerous tributaries. Threats to longfin dace are similar to those of the suckers, primarily being nonnative aquatic species and habitat destruction and alteration.

Nonnative Species

Nonnative species currently present a significant threat to all native fish species. Prior to Euro-American settlement, nonnative species were not present. However, most of the streams and lakes on the Apache-Sitgreaves NFs are managed by the AZGFD for, or contain, socially desirable nonnative species (e.g., sport fish). Crayfish are also widely distributed and are usually found in high densities and are considered an undesirable, nonnative species.

Fish Recovery Efforts

Fisheries habitat improvement in streams began in the 1930s on the Apache-Sitgreaves NFs. The efforts were probably in response to highly degraded habitat conditions (likely from livestock grazing) and were focused on higher elevation trout streams to stabilize streams and provide pool habitat that had been reduced. Later efforts in the 1970s and 1980s focused on areas that had been impacted by past management activities and concentrated recreation use (e.g., East Fork of the Black River, West Fork of the Little Colorado River). Considerable efforts were made in the 1990s to improve conditions for Apache trout recovery by installing habitat improvements in several streams, primarily on the Springerville Ranger District. Recent efforts related to Apache trout recovery have focused on fish barrier maintenance and chemical treatment of streams to remove nonnative species. Efforts under current plan implementation to provide for other federally listed and other native fish species have been limited to the introduction of one Little Colorado spinedace population in West Chevelon Canyon and a recently completed analysis for construction of a fish barrier on the lower Blue River.

Environmental Consequences of Alternatives

Fish Species Viability

The process to assess the diversity of ecosystems and wildlife for the Apache-Sitgreaves NFs began prior to plan revision and was prepared in support of the “Apache-Sitgreaves NFs Ecological Sustainability Report” (Forest Service, 2008e). This report summarized the diversity of ecosystems, including the diversity of animals and plants, on the Apache-Sitgreaves NFs. As a result of this report, species were initially identified as having potential or possible risk to their viability; the identification of these species and their potential viability risks helped with development of plan direction to address or reduce the risk. Since 2009, this list has been refined and updated, with a final list of 109 species considered “forest planning species” (i.e., species with potential risk to their viability). For more detail, see the “Iterative Update to Species Considered and Identification of Forest Planning Species Report” (Forest Service, 2012b).

A total of 14 native fish species occur on the Apache-Sitgreaves NFs, of which 7 are listed as endangered or threatened under the Endangered Species Act, and 6 are listed by the Regional Forester as sensitive. All 14 native fish species are considered as forest planning species. The other 95 non-fish forest planning species are discussed in the “Wildlife and Rare Plants” section.

As part of the revision process, plan decisions were developed that describe desired conditions for ecosystems, PNVT types, fire regimes, riparian and aquatic habitat, and wildlife within the planning area. For species determined to be at low risk, the “coarse filter” plan decisions (e.g. desired conditions, objectives) would provide and maintain viability. For those species at some risk to their viability, additional “fine filter” plan decisions were developed (e.g., standards, guidelines) to contribute and provide for viability to reduce risk. Table 18 provides a summary of the plan decisions—at the coarse filter and fine filter level—for fish species that are necessary to reduce population viability concerns to a low risk level. A listing of the coarse and fine filter plan decisions can be found below. In addition, fine filter plan decisions can be found in appendix G.

Table 18. Sections of the plan containing plan decisions that address fish species at the coarse and fine filter levels

Plan decision	Desired Conditions	Objectives	Standards	Guidelines
Coarse Filter plan decisions that provide viability for: bluehead sucker, desert sucker, Little Colorado sucker, longfin dace, razorback sucker, Sonora sucker, speckled dace, Apache trout, Gila chub, Gila trout, Little Colorado spinedace, roundtail chub, loach minnow, and spinedace	Ecosystem Health Soil Water Resources Aquatic Habitat and Species All PNVTs Riparian Areas Invasive Species	Ecosystem Health Soil Aquatic Habitat and Species All Forested PNVTs All Woodland PNVTs Grasslands Invasive Species Water Uses		
Fine Filter plan decisions in addition to the coarse filter plan decisions above that provide viability for: Apache trout, Gila chub, Gila trout, Little Colorado spinedace, roundtail chub, loach minnow, and spikedace			Water Resources Aquatic Habitat and Species Vegetation Invasive Species Water Uses	Soil Water Resources Aquatic Habitat and Species Vegetation Riparian Areas Invasive Species Landscape Scale Disturbance Events Motorized Opportunities Nonmotorized Opportunities Livestock Grazing Minerals and Geology

Coarse Filter

All alternatives would provide for the viability of all native fish species by maintaining and/or improving their habitat and populations through implementation of various plan decisions. The desired conditions below are the same for **all alternatives** and address viability concerns for all native fish species and their habitats that have primarily been impacted by habitat loss and alteration and the introduction and spread of nonnative fish and other aquatic invasive species.

The implementation of plan decisions for **all alternatives** may have some short-term indirect effects to aquatic habitat and fish populations, but would result in long-term benefits to the maintenance and improvement of aquatic habitat and species populations. Long-term benefits would occur by moving overall conditions closer to reference conditions while increasing and improving ecosystem resiliency and, therefore, the aquatic habitat and fish species they contain (see the “Soil,” “Watershed,” “Water Resources,” “Riparian,” “Vegetation,” and “Invasive Species” sections).

Desired conditions (coarse filter plan decisions) as described in the “Overall Ecosystem Health,” “Soil,” “Water Resources,” “Water Uses,” “Aquatic Habitat and Species,” “Vegetation,” “Riparian Areas,” and “Invasive Species” sections of the plan would help provide for the viability of bluehead sucker, desert sucker, Little Colorado sucker, longfin dace, razorback sucker, Sonora sucker, and speckled dace as described in the next several paragraphs. These desired conditions would also help contribute to the viability of Apache trout, Gila chub, Little Colorado spinedace, roundtail chub, loach minnow, and spikedace.

The desired conditions and objective in overall ecosystem health that contribute and provide for viability include the following:

- Desired Condition: Ecological components (e.g., soil, vegetation, water) are resilient to disturbances including human activities and natural ecological disturbances (e.g., climate variability, fire, drought, wind, insects, disease, pathogens).
- Desired Condition: Natural ecological disturbances return to their characteristic roles within the ecosystem. Wildfire, in particular, is restored to a more natural function.
- Desired Condition: Natural ecological cycles (i.e., hydrologic, energy, nutrient) facilitate shifting of plant communities, structure, and ages across the landscape. Ecotone shifts are influenced at both the landscape and watershed scale by ecological processes. The mosaic of plant communities and the variety within the communities are resilient to disturbances.
- Desired Condition: Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of native and desirable nonnative plants and animals that are healthy, well distributed, connected, and genetically diverse. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the landscape.
- Desired Condition: Large blocks of habitat are interconnected, allowing for behavioral and predator-prey interactions, and the persistence of metapopulations and highly interactive wildlife species across the landscape. Ecological connectivity extends through all plant communities.
- Desired Condition: Habitat configuration and availability allows wildlife populations to adjust their movements (e.g., seasonal migration, foraging) in response to climate change and promote genetic flow between wildlife populations.
- Desired Condition: Habitat quality, distribution, and abundance exist to support the recovery of federally listed species and the continued existence of all native and desirable nonnative species.
- Desired Condition: Healthy ecosystems provide a wide range of ecosystem services.
- Desired Condition: Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.

- Objective: During the planning period, improve the condition class on at least 10 priority 6th level HUC watersheds by removing or mitigating degrading factors.

Plan implementation toward these desired conditions would improve ecological conditions and move conditions closer to reference conditions for vegetation, watersheds, and riparian areas. Additionally, ecological processes across these areas and landscapes would improve overall ecosystem function and condition and reduce the potential for high severity fire. Restoration treatments and management actions for these desired conditions would improve vegetation, soil, watershed, riparian, and aquatic habitat conditions within the planning area and would help provide long-term benefits by maintaining and improving aquatic habitat and fish species populations (i.e., viability) across the forests.

Desired conditions and objective for soils that contribute and provide for viability include the following:

- Desired Condition: Ecological and hydrologic functions are not impaired by soil compaction.
- Desired Condition: Soil condition rating is satisfactory.
- Desired Condition: Soils are stable within their natural capability. Vegetation and litter limit accelerated erosion (e.g., rills, gullies, root exposure, topsoil loss) and contribute to soil deposition and development.
- Desired Condition: Soils provide for diverse native plant species. Vegetative ground cover (herbaceous vegetation and litter) is distributed evenly across the soil surface to promote nutrient cycling, water infiltration, and maintain natural fire regimes.
- Desired Condition: Biological soil crusts (mosses, lichens, algae, liverworts) are present and reestablished if potential exists.
- Desired Condition: Soil loss rates do not exceed tolerance soil loss rates.
- Desired Condition: Logs and other woody material are distributed across the surface to maintain soil productivity.
- Desired Condition: Vegetation and litter are sufficient to maintain and improve water infiltration, nutrient cycling, and soil stability.
- Objective: Annually, enhance or restore an average of 350 acres within priority 6th level HUC watersheds, including treating the causes of State and federally designated impaired or threatened waters to improve watershed condition and water quality.

The improvement in soil conditions resulting from plan implementation toward these desired conditions would help improve and move hydrologic function and watershed conditions toward reference conditions and greater resiliency. Soil condition improvements would help improve water and aquatic habitat quality in the long term. Sedimentation from runoff would be reduced as watershed conditions are improved.

Desired conditions for all PNVTs that contribute and provide for viability include the following:

- Desired Condition: Each PNVT contains a mosaic of vegetative conditions, densities, and structures. This mosaic occurs at a variety of scales across landscapes and watersheds. The distribution of physical and biological conditions is appropriate to the natural disturbance regimes affecting the area.

- Desired Condition: The vegetative conditions and functions are resilient to the frequency, extent, and severity of ecological disturbances (e.g., fire, insects and disease, flood, climate variability). The landscape is a functioning ecosystem that contains all its components, processes, and better able to cope with climate change.
- Desired Condition: Natural processes and human and natural disturbances (e.g., wildland fire, mechanical vegetation treatments) provide desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. Natural fire regimes are restored. Uncharacteristic fire behavior is minimal or absent on the landscape.
- Desired Condition: Wildland fire maintains and enhances resources and, as nearly as possible, is allowed to function in its natural ecological role.
- Desired Condition: Native plant communities dominate the landscape.
- Desired Condition: The range of species genetic diversity remains within native vegetation and animal populations, thus enabling species to adapt to changing environmental and climatic conditions.
- Desired Condition: Vegetative connectivity provides for species dispersal, genetic exchange, and daily and seasonal movements across multiple spatial scales.
- Desired Condition: Vegetation characteristics (e.g., density, litter) provide favorable conditions for water flow and quality.
- Desired Condition: Organic soil cover and herbaceous vegetation protect soil, facilitate moisture infiltration, and contribute to plant and animal diversity and ecosystem function.
- Desired Condition: Diverse vegetation structure, species composition, densities, and seral states provide quality habitat for native and desirable nonnative plant and animal species throughout their life cycle and at multiple spatial scales. Landscapes provide for the full range of ecosystem diversity at multiple scales, including habitats for those species associated with late seral states and old growth forests.
- Desired Condition: Old growth is dynamic in nature and occurs in well-distributed patches that spatially shift across forest and woodland landscapes over time.
- Desired Condition: Old or large trees, multistoried canopies, large coarse woody debris, and snags provide the structure, function, and associated vegetation composition as appropriate for each forested and woodland PNVT.
- Desired Condition: Vegetation conditions allow for transition zones or ecotones between riparian areas, forests, woodlands, shrublands, and grasslands. Transition zones may shift in time and space due to changing site conditions from disturbances (e.g., fire, climate variability).
- Desired Condition: Insect and disease populations are at endemic levels with occasional outbreaks. A variety of seral states usually restricts the scale of localized insect and disease outbreaks.
- Desired Condition: Stand densities and species compositions are such that vegetation conditions are resilient under a variety of potential future climates.
- Desired Condition: Vegetation conditions provide hiding and thermal cover in contiguous blocks for wildlife. Native plant species are present in all age classes and are healthy, reproducing, and persisting.
- Desired Condition: Vegetative ground cover (herbaceous vegetation and litter) is optimized to protect and enrich soils and promote water infiltration. There is a diverse mix of cool and warm season grasses and desirable forbs species.

- Desired Condition: Grasses, forbs, shrubs, and litter are abundant and continuous to support natural fire regimes.
- Desired Condition: The composition, density, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities and forest ecosystems.

Plan implementation toward these desired conditions would help move the PNVTs closer to their ecological composition, structure, and processes relative to reference conditions. The closer each PNVT is to reference conditions, the more secure dependent species are within the associated habitats. PNVT improvements would reestablish the natural patterns and processes within these vegetation communities that allow for natural resiliency; especially important when faced with uncharacteristic wildfire, the presence of invasive species, and climate change.

Desired deconditions for water resources and uses that contribute and provide for viability include the following:

- Desired Condition: Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances.
- Desired Condition: Water resources maintain the capability to respond and adjust to disturbances without long-term adverse changes.
- Desired Condition: Vegetation and soil conditions above the floodplain protect downstream water quality, quantity, and aquatic habitat.
- Desired Condition: Instream flows provide for channel and floodplain maintenance, recharge of riparian aquifers, water quality, and minimal temperature fluctuations.
- Desired Condition: Streamflows provide connectivity among fish populations and provide unobstructed routes critical for fulfilling needs of aquatic, riparian dependent, and many upland species of plants and animals.
- Desired Condition: Stream channels and floodplains are dynamic and resilient to disturbances. The water and sediment balance between streams and their watersheds allow a natural frequency of low and high flows.
- Desired Condition: Stream condition is sufficient to withstand floods without disrupting normal stream characteristics (e.g., water transport, sediment, woody material) or altering stream dimensions (e.g., bankfull width, depth, slope, sinuosity).
- Desired Condition: Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare.
- Desired Condition: Water quality meets or exceeds Arizona State standards or Environmental Protection Agency water quality standards for designated uses.
- Desired Condition: Water developments contribute to fish, wildlife, and riparian habitat as well as scenic and aesthetic values.
- Desired Condition: Apache-Sitgreaves NFs water rights are secure and contribute to livestock, recreation, wildlife, and administrative uses.

Plan implementation toward these desired conditions would ensure water quality, quantity, and connectivity occurs across the forests, along with improving watershed and hydrologic conditions necessary for maintaining and improving riparian areas and aquatic habitats.

Desired conditions and objectives for aquatic habitat and species that provide viability for bluehead sucker, desert sucker, Little Colorado sucker, longfin dace, razorback sucker, Sonora sucker, and speckled dace include the following:

- Desired Condition: Streams and aquatic habitats support native fish and/or other aquatic species providing the quantity and quality of aquatic habitat within reference conditions.
- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Streamflows, habitat, and water quality support native aquatic and riparian dependent species and habitat.
- Desired Condition: Habitat and ecological conditions are capable of providing for self-sustaining populations of native, riparian dependent plant and animal species.
- Desired Condition: Native fish, reptile, amphibian, and invertebrate populations are free from or minimally impacted by nonnative plants and animals.
- Desired Condition: Aquatic species habitat conditions provide the resiliency and redundancy necessary to maintain species diversity and metapopulations.
- Desired Condition: Desirable nonnative fish species provide recreational fishing in waters where those opportunities are not in conflict with the recovery of native species.
- Desired Condition: Wetlands are hydrologically functioning and have sufficient (composing 50 percent of the wetland) emergent vegetation and macroinvertebrate populations to support resident and migratory wetland-dependent species.
- Objective: Annually, enhance or restore 5 to 15 miles of stream and riparian habitat to restore structure, composition, and function of physical habitat for native fisheries and riparian-dependent species.
- Objective: During the planning period, complete at least five projects (e.g., remove barriers, restore dewatered stream segments, or connect fragmented habitat) to provide for aquatic and riparian associated species and migratory species.

Plan implementation toward these desired conditions and objectives would help improve aquatic habitat conditions for all native fish species, reduce impacts associated with nonnative species, and improve distributions and resiliency of threatened and endangered fish species. Conditions for all native fish species would improve by addressing habitat and loss and alteration of habitat by moving conditions closer to reference conditions.

Desired conditions for riparian areas that provide for viability include the following:

- Desired Condition: Natural ecological disturbances (e.g., flooding, scouring) promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all ages and size classes necessary for the recruitment of riparian-dependent species.
- Desired Condition: Riparian-wetland conditions maintain water-related processes (e.g., hydrologic, hydraulic, geomorphic). They also maintain the physical and biological community characteristics, functions, and processes.
- Desired Condition: Stream (lotic) riparian-wetland areas have vegetation, landform, and/or large coarse woody debris to dissipate stream energy associated with high water flow.

- Desired Condition: Streams and their adjacent floodplains are capable of filtering, processing, and storing sediment; aiding floodplain development; improving floodwater retention; and increasing groundwater recharge.
- Desired Condition: Vegetation and root masses stabilize stream banks, islands, and shoreline features against the cutting action of water.
- Desired Condition: Ponding and channel characteristics provide habitat, water depth, water duration, and the temperatures necessary for maintaining populations of riparian-dependent species and for their dispersal.
- Desired Condition: Lentic riparian areas (e.g., wet meadows, fens, bogs) have vegetation and landform present to dissipate wind action, wave action, and overland flow from uplands.
- Desired Condition: Wetland-riparian areas are capable of filtering sediment and aiding floodplain development that contribute to water retention and groundwater recharge.
- Desired Condition: The spatial extent of wetlands is maintained.
- Desired Condition: Soil compaction from forest activities (e.g., vehicle use, recreation, livestock grazing) does not negatively impact riparian areas.
- Desired Condition: Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.
- Desired Condition: The ecological function of riparian areas is resilient to animal and human use.
- Desired Condition: Riparian-obligate species within wet meadows, along stream banks, and active floodplains provide sufficient vegetative ground cover (herbaceous vegetation and litter) to protect and enrich soils, trap sediment, mitigate flood energy, stabilize stream banks, and provide for wildlife and plant needs
- Desired Condition: Riparian soil productivity is optimized as described by the specific TES map unit under consideration as indicated by the vigor of the herbaceous vegetation community. Based on species composition, ungrazed plant heights range from 10 inches to 36 inches.
- Desired Condition: Large coarse woody debris provides stability to riparian areas and stream bottoms lacking geologic control (e.g., bedrock) or geomorphic features (e.g., functioning floodplains, stream sinuosity, width/depth ratio).

Plan implementation toward these desired conditions would help improve conditions for all native fish species by addressing habitat and loss and alteration of habitat by moving conditions closer to reference conditions.

Desired conditions and objective for invasive species that provide for viability include the following:

- Desired Condition: Invasive species (both plant and animal) are nonexistent or in low occurrence to avoid negative impacts to ecosystems.
- Desired Condition: Undesirable nonnative species are absent or present only to the extent that they do not adversely affect ecosystem composition, structure, or function, including native species populations or the natural fire regime.
- Desired Condition: Introduction of additional invasive species rarely occurs and is detected at an early stage.

- Objective: Annually control or eradicate invasive species (e.g., tamarisk, bullfrogs) on at least 2 stream miles.

Plan implementation toward these desired conditions would help improve conditions for all native fish species by addressing threats to those species from nonnative invasive species.

In addition to the above, objectives for all forested PNVTs, all woodland PNVTs, grasslands, and water uses would also help contribute to species viability by moving vegetation conditions closer to desired conditions and securing water rights. These include the following:

- Objective: Annually treat 5,000 to 35,000 acres to reduce tree densities, restore natural fire regimes, promote species habitat and ecosystem health, reduce fire hazard, maintain desired conditions, initiate recovery from uncharacteristic disturbance, and provide forest products, leaving a desired mix of species with the range of desired densities that are resilient to changing climatic conditions.
- Objective: Annually treat or maintain 5,000 to 15,000 acres to promote a highly diverse structure.
- Objective: Decrease or maintain the woody canopy cover at less than 10 percent by treating up to 25,000 acres annually.
- Objective: Annually prepare at least one instream flow water rights application until water acquisition needs are complete to sustain riparian areas, fish, wildlife, and water-based recreation.

Fine Filter

While the above coarse filter desired conditions provide and maintain viability for numerous fish species, additional fine filter plan decisions were needed for those fish species with higher risk to their viability. These species include Apache trout, Gila chub, Little Colorado spinedace, roundtail chub, loach minnow, and spikedace. The plan decisions (i.e., fine filter standards and guidelines) discussed below are applicable and necessary for the six fish species listed. They are applicable to all six species as the potential impacts to watersheds, riparian areas, and aquatic habitats are similar; the specific threats to these species are also similar (e.g., sedimentation, nonnative species).

The fine filter plan decisions are designed to address the threats and risks to these species, especially as they relate to potential short-term impacts. These standards and guidelines were developed to ensure species viability by improving and maintaining habitat and populations across the forests, while minimizing any potential short-term impacts associated with restoration treatments and management activities.

As these species are more vulnerable to short-term habitat impacts due to their lower population numbers and reduced distributions, the additional standards and guidelines would provide for viability by addressing the primary concerns associated with habitat loss and alteration, nonnative species, and uncharacteristic landscape-scale disturbances (e.g., uncharacteristic fire).

The standards and guidelines identified in the “Invasive Species,” “Landscape Scale Disturbance Events,” “Riparian Areas,” “Water Resources,” “Water Uses,” “Motorized Opportunities,” “Aquatic Habitat and Species,” and “Livestock Grazing” sections of the plan under **all alternatives** contribute and provide for viability for Apache trout, Gila chub, Little Colorado spinedace, roundtail chub, loach minnow, and spikedace. A list of these fine filter plan decisions can also be found in appendix G.

Fine filter plan decisions for invasive species include the following:

- Standard: Projects and authorized activities shall be designed to reduce the potential for the introduction of new species or spread of existing invasive or undesirable aquatic or terrestrial nonnative populations.
- Guideline: Project areas should be monitored to ensure there is no introduction or spread of invasive species.
- Guideline: Treatment of invasive species should be designed to effectively control or eliminate them; multiple treatments may be needed.
- Guideline: Pesticide use should minimize impacts on nontarget plants and animals.
- Guideline: Projects and activities should not transfer water between drainages or between unconnected waterbodies within the same drainage to avoid spreading disease and aquatic invasive species.

As nonnative species are negatively impacting all federally listed fish species, these plan decisions would reduce current impacts and ensure restoration treatments and management actions do not result in additional impacts from invasive species or actions taken to control existing nonnative populations.

Fine filter plan decisions for landscape scale disturbance include the following:

- Guideline: Erosion control mitigation features should be implemented to protect significant resource values and infrastructure such as stream channels, roads, structures, threatened and endangered species, and cultural resources.
- Guideline: Projects and activities (e.g., revegetation, mulching, lop and scatter) should be designed to stabilize soils and restore nutrient cycling, if needed, and establish movement toward the desired conditions for the affected PNVT(s).

Due to their limited and/or reduced distributions and isolated populations, federally listed fish species are more susceptible to large-scale disturbances (e.g., wildfire) that can also negatively impact vegetation, watersheds, riparian areas, and aquatic habitat. When large-scale disturbances occur, these guidelines would ensure that conditions required for the restoration of ecological functions and processes would be in place and any potential impacts to streams and federally listed species would be minimized.

Fine filter plan decisions for riparian areas include the following:

- Guideline: Storage of fuels and other toxicants should be located at least 100 feet outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
- Guideline: Equipment should be fueled or serviced at least 100 feet outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
- Guideline: Construction or maintenance equipment service areas should be located at least 100 feet from riparian areas and treated to prevent gas, oil, or other contaminants from washing or leaching into streams.

- Guideline: Wet meadows and cienegas should not be used for concentrated activities (e.g., equipment storage, forest product or mineral stockpiling, livestock handling facilities, special uses) that cause damage to soil and vegetation.
- Guideline: Active grazing allotments should be managed to maintain or improve to desired riparian conditions.

These guidelines would minimize potential impacts to riparian vegetation, water quality, aquatic habitat, and fish species associated with restoration treatments and/or management actions.

Fine filter plan decisions for water resources and water uses include the following:

- Guideline: Streams, stream banks, shorelines, lakes, wetlands, seeps, springs and other bodies of water should be protected from detrimental changes in water temperature and sediment to protect aquatic species and riparian habitat.
- Guideline: Aquatic management zones should be in place between streams and disturbed areas and/or road locations to maintain water quality and suitable stream temperatures for aquatic species.
- Guideline: As State of Arizona water rights permits (e.g., water impoundments, diversions) are issued, the base level of instream flow should be retained by the Apache-Sitgreaves NFs.
- Guideline: Constraints (e.g., maximum limit to which water level can be drawn down, minimum distance from a connected river, stream, wetland, or groundwater-dependent ecosystem) should be established for new groundwater pumping sites permitted on NFS lands in order to protect the character and function of water resources.
- Standard: Streams on NFS lands with high aquatic values and at risk from new water diversions shall be preserved and protected with instream flow water rights.
- Standard: Groundwater withdrawals shall not measurably diminish surface water flows on NFS lands without an appropriate surface water right.
- Standard: Consistent with existing water rights, water diversions or obstructions shall at all times allow sufficient water to pass downstream to preserve minimum levels of water flow which maintain aquatic life and other purposes of national forest establishment.

Where water uses and management of resources occur, the potential to impact water quality, riparian areas and vegetation, aquatic habitat, and fish may occur. The standards and guidelines for water resources and uses would minimize and mitigate any potential impacts by protecting aquatic habitat and species from disturbance by implementing streamside management zones.

Fine filter plan decisions for motorized opportunities include the following:

- Guideline: New roads, motorized trails, or designated motorized areas should be located to avoid meadows, wetlands, riparian areas, stream bottoms, sacred sites, and areas with high concentrations of significant archaeological sites. The number of stream crossings should be minimized or mitigated to reduce impacts to aquatic species.
- Guideline: Roads and motorized trails removed from the transportation network should be treated in order to avoid future risk to hydrologic function and aquatic habitat.
- Guideline: As projects occur, existing meadow crossings should be relocated or redesigned, as needed, to maintain or restore hydrologic function using appropriate tools such as French drains and elevated culverts.

- Guideline: New trails and trail relocations should be designed and located so as to not impede terrestrial and aquatic species movement and connectivity.

These guidelines for motorized opportunities would minimize potential impacts to or conflicts with aquatic species and habitats by maintaining and improving hydrologic conditions and functions and avoiding riparian areas.

Fine filter plan decisions for aquatic habitat and species include the following:

- Guideline: The needs of rare and unique species associated with wetlands, fens, bogs, seeps, and springs should be given priority consideration when developing these areas for waterfowl habitat and other uses.
- Guideline: Sufficient water should be left in streams to provide for aquatic species and riparian vegetation.
- Guideline: Projects and activities should avoid damming or impounding free-flowing waters to provide streamflows needed for aquatic and riparian-dependent species.
- Standard: When drafting (withdrawing) water from streams or other waterbodies, measures will be taken to prevent entrapment of fish and aquatic organisms and the spread of parasites or disease (e.g., Asian tapeworm, chytrid fungus, whirling disease).
- Guideline: When new water diversions are created or existing water diversions are reanalyzed, measures should be taken to prevent entrapment of fish and aquatic organisms.
- Guideline: To prevent degradation of native species habitat and the incidental or accidental introduction of diseases or nonnative species, aquatic species should not be transferred through management activities from one 6th level HUC watershed to another.

As stated previously, habitat loss and alteration and nonnative species are the primary concerns for most native and federally listed fish species. These standards and guidelines for aquatic habitat and species would provide for the habitat needs for fish species, while reducing and minimizing any potential impacts associated with nonnative species.

Fine filter plan decisions for livestock grazing include the following:

- Guideline: Critical areas should be managed to address the inherent or unique site factors, condition, values, or potential conflicts associated with them.
- Guideline: New livestock troughs, tanks, and holding facilities should be located out of riparian areas to reduce concentration of livestock in these areas. Existing facilities in riparian areas should be modified, relocated, or removed where their presence is determined to inhibit movement toward desired riparian or aquatic conditions.
- Guideline: To minimize potential resource impacts from livestock, salt or nutritional supplements should not be placed within a quarter mile of any riparian area or water source. Salt or nutritional supplements should also be located to minimize herbivory impacts to aspen clones.
- Guideline: To prevent resource damage (e.g., stream banks) and disturbance to federally listed and sensitive wildlife species, trailing of livestock should not occur along riparian areas. Where no alternative route is available, approval may be granted where effective mitigation measures are implemented (e.g., timing of trailing, number of livestock trailed at one time).

The removal and/or relocation of livestock trailing, waters, holding facilities, salt, and nutritional supplements away from waters and riparian areas would help reduce potential negative impacts to riparian vegetation, water quality, and aquatic habitats.

Overall Environmental Consequences

In **all alternatives** implementation of plan decisions (i.e., desired conditions, objectives, standards, guidelines, suitability, special areas, and monitoring) may have both short-term and long-term environmental consequences that are positive, negative, or neutral to aquatic and riparian habitat and fish populations. Improvements in vegetation conditions, primarily through mechanical treatments and fire management activities, along with watershed improvements may result in long-term beneficial impacts that could improve aquatic habitat conditions and fish populations. These potential beneficial impacts would be dependent on the extent to which these treatments occur within watersheds occupied or identified for the recovery of fish species. Although ecosystem, watershed, riparian, and aquatic habitat conditions have varying departures from reference conditions, achievement or movement toward desired conditions would improve these conditions across the Apache-Sitgreaves NFs.

Vegetation, fuels, and wildland fire restoration treatments can influence and improve aquatic habitat conditions across the Apache-Sitgreaves NFs. Watershed, riparian, and aquatic habitat treatments would have the greatest potential to positively impact aquatic habitat. Through implementation of plan decisions (i.e., desired conditions and objectives) for ecosystem health, soils, water resources, aquatic habitat and species, vegetation, riparian areas, invasive species, and water uses, both the physical and biological processes for maintaining and improving aquatic habitat and fish populations would move toward reference conditions across the Apache-Sitgreaves NFs and provide for viability and recovery for threatened, endangered, and sensitive fish species.

Within the Apache-Sitgreaves NFs and areas downstream, management activities may impact fish species and their critical/potential habitat. Impacts to hydrologic conditions (i.e., changes in water quantity and quality) and riparian and aquatic habitats are the result of vegetation alterations, soil erosion, and sedimentation from ground-disturbing activities. These include, but are not limited to, wildland fire and mechanical treatments, timber harvesting, livestock grazing, road construction and maintenance, recreation, and developments. How watersheds, riparian areas, and streams respond to management activities would be influenced by their geology, soils, vegetation conditions and cover, their existing conditions at the time of the impact, and environmental conditions that exist after impact has occurred. As mentioned in the previous section, **all alternatives** contain plan decisions to address and minimize potential short-term negative impacts to all of the endangered, threatened, and sensitive fish species and their habitats on the Apache-Sitgreaves NFs.

Endangered Species Act Species and Critical Habitat

In **all alternatives** the implementation of plan decisions related to ecosystem health, soils, water resources, aquatic habitat and species, vegetation, riparian areas, and invasive species may have short-term negative effects, but may also result in long-term beneficial environmental consequences to the maintenance and improvement of fish species populations and habitats on the Apache-Sitgreaves NFs.

ESA Determinations for All Alternatives

Two biological assessments (BAs) address effects of forest plans to ESA species in accordance with Section 7(a)(1) of the Endangered Species Act. Determination of effects for the continued implementation of the 1987 plan are found in the April 6, 2011 BA (Forest Service, 2011a). These findings are shown in table 19 below (fish ESA species) and represent the determination of effects to 2011 species and critical habitat should alternative A, the 1987 plan, continue to be implemented. Findings for ESA non-fish species are found in table 85.

A May 29, 2014 biological assessment was prepared for alternative B for plan revision. The determination of effects for species and critical habitat for ESA species and the BA findings for them (Forest Service, 2014cc) are also shown in table 19 below. This BA was submitted to the U.S. Fish and Wildlife Service for formal consultation on May 29, 2014.

Note that it is assumed that implementation of alternatives C and D would result in similar determinations as alternative B, although the level of effects to ESA species would likely be different. However, alternatives C and D are not analyzed in a biological assessment.

Table 19. Determination of effects (findings) for ESA species for alternatives A and B

Species	Status	2011 BA Findings (Alternative A) [a]	Findings Alternative B
Apache trout	Threatened	May affect, likely to adversely affect	May affect, likely to adversely affect
Gila chub	Endangered Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect	May affect, likely to adversely affect May affect, likely to adversely affect
Gila trout	Threatened	May affect, likely to adversely affect	May affect, likely to adversely affect
Little Colorado spinedace	Threatened Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect	May affect, likely to adversely affect May affect, likely to adversely affect
Loach minnow	Endangered Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect	May affect, likely to adversely affect May affect, likely to adversely affect
Spikedace	Endangered Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect	May affect, likely to adversely affect May affect, likely to adversely affect
Razorback sucker	Endangered Critical habitat	NA[b]	No effect No effect
Roundtail chub	Candidate	May affect, likely to adversely affect	Not likely to jeopardize, if proposed

[a] Alternative A findings are based on current 1987 plan direction; plan direction is not reinterated here.

[b] Razorback sucker was not analyzed in the 2011 BA or the 2012 BO on the Apache-Sitgreaves NFs.

Determinations of effects were the same for alternatives A and D, although the razorback sucker and roundtail chub were not addressed for the current 1987 plan. Roundtail chub was included in this FEIS analysis as it is a candidate species, and the razorback sucker was included as critical habitat occurs downstream off the Apache-Sitgreaves NFs. As discussed within the BA, standards and guidelines in alternative B would protect or mitigate potential effects to fish and aquatic/riparian areas from the Wildland Fire Management, Ecosystem/Vegetation Health, Rangeland Management, Watershed and Soil management Engineering, Lands and Minerals, and

Wildlife, Fish and Rare Plant program activities. The desired conditions and objectives included with alternative B would help promote the restoration of PNVTs, natural fire regimes, watersheds, aquatic and riparian areas, and incorporate recovery actions and conservation strategies for federally listed and candidate species. These standards and guidelines would help to maintain federally listed and candidate fish species; although as determined within the BA, the extent to which impacts are reduced or eliminated cannot be considered insignificant or discountable.

Overall Alternative Comparisons for ESA Fish Species

While **all alternatives** provide for the needs of ESA fish species by moving habitat conditions closer to desired or reference conditions, plan objectives vary between the alternatives and their outcomes determine the potential for fish habitat and population improvements across the Apache-Sitgreaves NFs.

- Stream and riparian habitat restoration treatment objectives for native fish species for **alternatives B and C** are 5 to 15 miles per year, less than 10 miles per year for **alternative A**, and on an opportunity basis for **alternative C**.
- Objectives for riparian habitat vegetation treatments are 5 miles per year for **alternatives B, C, and D**, and on an opportunity basis for **alternative A**.
- Aquatic invasive treatment objectives are 2 miles per year for **alternatives B, C, and D**, and on an opportunity basis for **alternative A**.
- Riparian restoration treatments for **alternative D** are 300 to 600 acres per year, 200 to 500 acres per year for **alternative B**, and on an opportunity basis for **alternatives A and C**.
- Road and trail restoration for streams and riparian areas are 4 miles over the planning period for **alternatives B and D**, and on an opportunity basis for **alternatives A and C**.

Plan decisions associated with ecosystems, soils, vegetation, and other restoration activities are not specifically discussed here; more specific information on these actions and their potential environmental consequences can be found in the appropriate EIS sections.

The overall greatest improvements for all the endangered and threatened fish species are likely to result through implementation of **alternative D**. **Alternative B** would result in similar improvements, but to a lesser extent than **alternative D**. **Alternative C** would not restore conditions to the extent of **alternative D or alternative B**, but would be greater than **alternative A**.

Sensitive Species

In **all alternatives** the implementation of plan decisions related to ecosystem health, soils, water resources, aquatic habitat and species, vegetation, riparian areas, and invasive species may have short-term negative environmental consequences, but would also result in long-term beneficial environmental consequences to the maintenance and improvement of sensitive fish species populations and habitats on the Apache-Sitgreaves NFs. The implementation of **all alternatives** would provide and maintain viability for all four sensitive fish species on the Apache-Sitgreaves NFs and would result in a “may impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability” determination for Desert sucker, Little Colorado River sucker, roundtail chub, and the Sonora sucker.

While **all alternatives** provide for viability by moving habitat conditions closer to reference conditions, plan objectives vary between the alternatives and these differences among outcomes would determine the potential for habitat and population improvements for sensitive fish species across the Apache-Sitgreaves NFs.

- Stream and riparian habitat restoration treatment objectives for native fish species for **alternatives B and C** are 5 to 15 miles per year, less than 10 miles per year for **alternative A**, and on an opportunity basis for **alternative C**.
- Objectives for riparian habitat vegetation treatments are 5 miles per year for **alternatives B, C, and D**, and on an opportunity basis for **alternative A**.
- Aquatic invasive treatment objectives are 2 miles per year for **alternatives B, C, and D**, and on an opportunity basis for **alternative A**.
- Riparian restoration treatments for **alternative D** are 300 to 600 acres per year, 200 to 500 acres per year for **alternative B**, and on an opportunity basis for **alternatives A and C**.
- Road and trail restoration for streams and riparian areas are 4 miles over the planning period for **alternatives B and D**, and on an opportunity basis for **alternatives A and C**.

Plan decisions associated with ecosystems, soils, vegetation, and other restoration activities are not specifically discussed here; more specific information on these actions and their potential environmental consequences can be found in the appropriate EIS sections.

The overall greatest improvements for all sensitive fish species are likely to result through implementation of **alternative D**; **alternative B** would result in similar improvements, but to a lesser extent. **Alternative C** would not restore conditions to the extent of **alternative D** or **alternative B**, but would be greater than **alternative A**. The biological evaluation for sensitive species is documented in the “Fisheries Specialist Report” (Forest Service, 2014g).

Restoration Treatment Activities

Under **all alternatives**, management actions to implement ecological restoration would include treating vegetation through wildland fire, timber harvest, and mechanical treatments across the landscape over the planning period. Treatments could affect aquatic habitat through increased runoff, erosion, sediment, and streamflow. All projects would minimize impacts to aquatic ecosystems and maintain habitat quantity and distribution by implementing appropriate plan direction. All treatments are intended to improve ecological conditions by restoring the natural fire regime, improving vegetation health and conditions, and reducing the potential for high severity wildfire. All treatments would result in improved watershed, soil, and vegetation conditions and, thus, would have long-term benefits of maintaining and improving aquatic habitats and fish species populations on the Apache-Sitgreaves NFs.

Watershed improvement projects would occur across the landscape across the forest; these projects would move soil and vegetation conditions toward satisfactory conditions. Closing and obliterating unauthorized routes would improve watershed conditions and decrease erosion. Improvement of stream crossings would reduce impacts to aquatic habitats from sedimentation. These projects would follow plan direction to minimize impacts to aquatic ecosystems and habitats and would have long-term benefits of maintaining or improving aquatic habitats and fish species populations across the Apache-Sitgreaves NFs.

The following sections provide further discussion and description of potential impacts. The severity of any unavoidable negative impacts may be reduced or minimized by designing mitigation measures for site-specific project implementation. Where management activities occur, some impacts cannot be avoided; therefore, some unavoidable impacts could occur to fish and aquatic habitats.

Table 3 in chapter 2 displays the restoration objectives, or planned treatment amounts, for each alternative. The restoration activities are used as indicators to compare the four alternatives relative to their potential impacts to fish and their habitats. Drainage areas were calculated for each species to aid these comparisons; the acreages presented for each species include all upland areas that drain into occupied, critical, or recovery habitat for each fish species. By limiting the analyses to only those areas that can impact and influence each fish species, this allows for a more meaningful comparison of the potential environmental consequences for each fish species for each alternative.

Figure 11 and figure 12 display the drainage areas that were analyzed for fish species and their habitats.

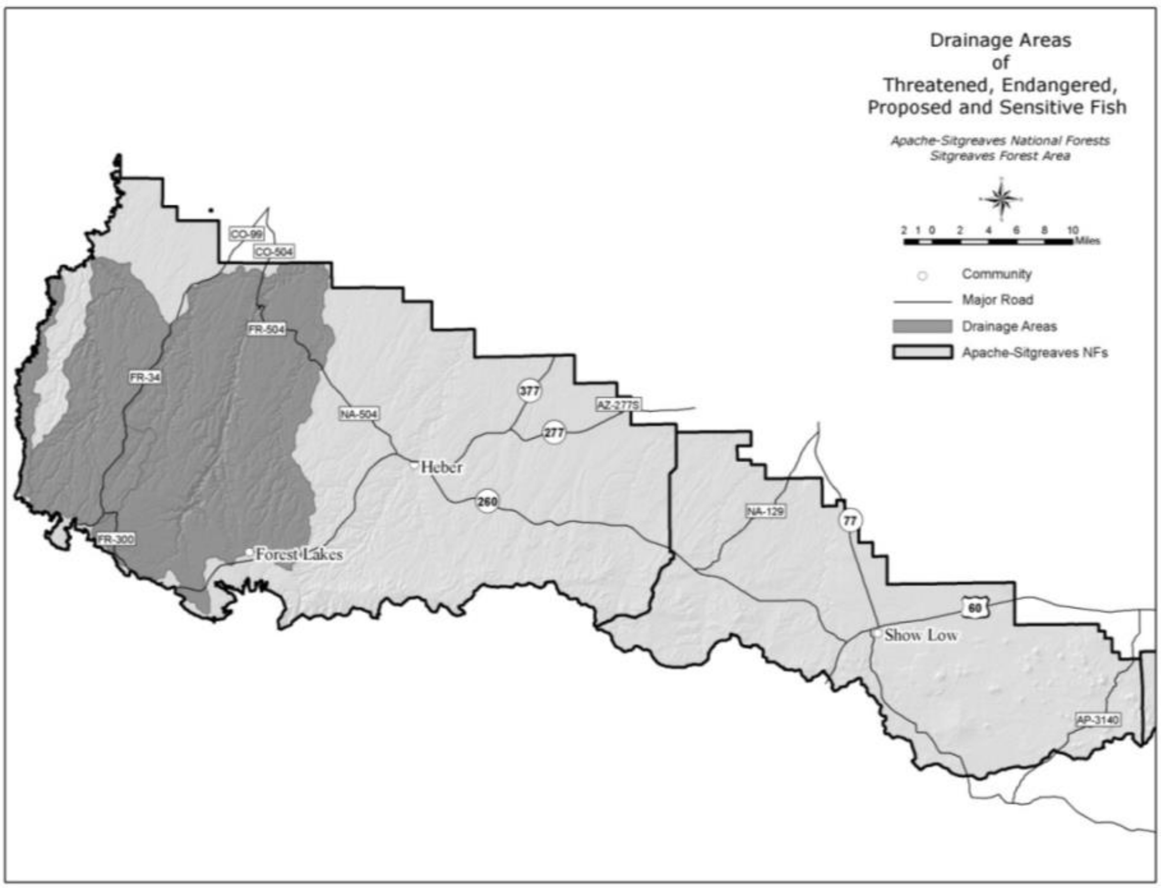

Figure 11. Map of fish drainage areas – Sitgreaves NF

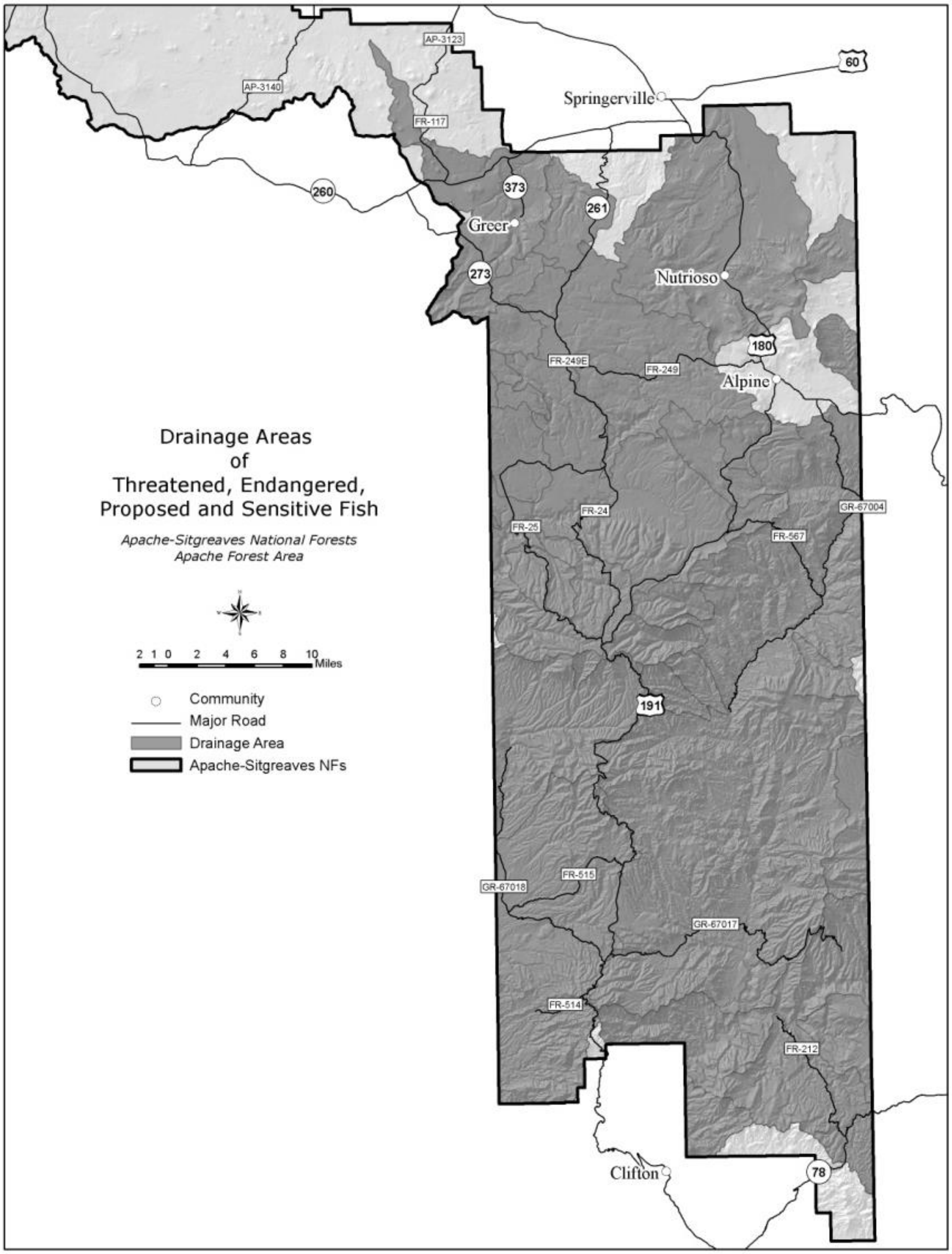

Figure 12. Map of fish drainage areas – Apache NF

Impacts Related to Mechanical and Wildland Fire Treatments

The primary vegetation management tools in **all alternatives** are mechanical and wildland fire treatments. While these activities would be implemented with the intent of restoring vegetative conditions (i.e., structure and composition) and natural fire regimes, the potential short- and long-term environmental consequences could vary by specific treatment types and combinations used.

Table 20 summarizes each alternative's total acreages and percent of habitat for each species that could potentially be treated during the planning period, by treatment type. The total potential treatment acres would not vary by alternative for any species, but the potential treatment methods would vary. These are primarily a result of the emphasis on mechanical treatments and lands managed for timber production on a regulated basis in **alternatives A, B, and C**. Overall, mechanical treatment lands are reduced (with no lands being managed for timber production on a regulated basis) and the use of wildland fire is increased in **alternative D**. It is assumed that 100 percent of each species drainage area would be treated, which would likely result in all species potentially impacted by one or more treatment methods within the planning period.

Table 20. Acres and percent of the species drainage area potentially affected by treatment type (mechanical and wildland fire) for each alternative

Species Drainage Area (acres[a])	Alternative A[b]		Alternative B		Alternative C		Alternative D	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Apache Trout (109,986)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	85,746	78%	82,663	75%	82,788	75%	72,986	66%
Lands where Only Wildland Fire Treatments Could Occur	24,018	22%	27,323	25%	27,198	25%	37,000	34%
Bluehead Sucker (374,967)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	326,673	87%	333,539	89%	333,533	89%	288,061	77%
Lands where Only Wildland Fire Treatments Could Occur	46,780	13%	41,429	11%	41,434	11%	86,907	23%
Desert Sucker (847,535)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	387,631	46%	396,467	47%	396,549	47%	238,983	28%
Lands where Only Wildland Fire Treatments Could Occur	459,140	54%	451,068	53%	450,986	53%	608,553	72%
Gila Chub (92,705)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	51,105	55%	51,105	55%	51,105	55%	8,657	9%
Lands where Only Wildland Fire Treatments Could Occur	41,600	45%	41,600	45%	41,600	45%	84,048	91%
Gila Trout (51,615)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	15,644	30%	15,645	30%	15,645	30%	12,126	23%
Lands where Only Wildland Fire Treatments Could Occur	35,971	70%	35,970	70%	35,970	70%	39,489	77%

Species Drainage Area (acres[a])	Alternative A[b]		Alternative B		Alternative C		Alternative D	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Little Colorado Spinedace (268,697)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	237,847	89%	243,409	91%	243,403	91%	204,344	76%
Lands where Only Wildland Fire Treatments Could Occur	30,240	11%	25,289	9%	25,294	9%	64,353	24%
LCR Sucker (180,663)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	166,424	92%	172,386	95%	172,387	95%	140,187	78%
Lands where Only Wildland Fire Treatments Could Occur	13,734	8%	8,276	5%	8,276	5%	40,476	22%
Loach Minnow (724,558)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	269,142	37%	279,439	39%	279,439	39%	131,468	18%
Lands where Only Wildland Fire Treatments Could Occur	454,651	63%	445,120	61%	445,120	61%	593,090	82%
Longfin Dace (634,010)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	201,812	32%	207,735	33%	207,734	33%	70,773	11%
Lands where Only Wildland Fire Treatments Could Occur	432,198	68%	426,276	67%	426,276	67%	563,237	89%
Razorback Sucker (637,401)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	203,907	32%	212,115	33%	212,115	33%	69,183	11%

Species Drainage Area (acres[a])	Alternative A[b]		Alternative B		Alternative C		Alternative D	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Lands where Only Wildland Fire Treatments Could Occur	433,494	68%	425,286	67%	425,286	67%	568,218	89%
Roundtail Chub (543,293)								
Lands where Mechanical and Wildland FireTreatments Could Occur	416,913	77%	425,790	78%	425,872	78%	321,579	59%
Lands where Only Wildland Fire Treatments Could Occur	125,127	23%	117,503	22%	117,421	22%	221,715	41%
Sonora Sucker (847,535)								
Lands where Mechanical and Wildland Fire TreatmentsCould Occur	387,631	46%	396,467	47%	396,549	47%	238,983	28%
Lands where Only Wildland Fire Treatments Could Occur	459,140	54%	451,068	53%	450,986	53%	608,553	72%
Spikedace (653,098)								
Lands where Mechanical and Wildland Fire Treatments Could Occur	209,436	32%	217,655	33%	217,655	33%	69,684	11%
Lands where Only Wildland Fire Treatments Could Occur	443,662	68%	435,444	67%	435,444	67%	583,414	89%

[a] The acres in parentheses represent the drainage area that influences the occupied habitat for each species; these acreages do not change by alternative.

[b] The sum of alternative A treatment acres does not equal the drainange area acres because the water management area is not included in this calculation.

Mechanical treatments include vegetation treatments and associated skidding, road improvement and maintenance (e.g., road use, new construction, reconstruction, temporary construction of roads), log and/or biomass transportation, piling, disposal/removal of slash, and site preparation. While these treatments could result in short-term impacts to specific treatment sites and cumulatively within a watershed, standards and guidelines would ensure any short-term impacts are minimized. Mechanical and wildland fire treatments improve forest health and vegetation conditions, restore a more natural fire regime, and reduce the potential for high severity wildfire. These ecological restoration actions would have long-term benefits to maintaining and improving aquatic habitats and maintaining fish species populations on the Apache-Sitgreaves NFs.

Alternatives A, B, and C would have the highest potential for short-term negative impacts to aquatic habitat and fish populations because they have the greatest area that could be mechanically treated. Negative impacts could occur when the hydrologic conditions, including increased sedimentation rates, of watersheds and riparian areas are altered. Potential negative impacts from **alternative D** would be less than those under **alternatives A, B, or C**, as fewer lands could be mechanically treated.

Potential long-term beneficial impacts would occur in **all alternatives** through improvements in vegetation conditions. Additionally, beneficial impacts to watersheds and riparian and aquatic habitat could occur through restoration of a more natural fire regime and reducing the potential for uncharacteristic wildfire. Potential impacts to fish species and aquatic habitats are associated with lands that can be treated either by mechanical or wildland fire treatments. While the proportion of treatment types (mechanical versus fire) varies between species, the outcomes associated with the treatments are similar for all species, as they would restore aquatic habitats and move toward desired conditions for all fish species.

Alternative A has the most acres (9 to 66 percent of species drainage areas) that would be managed as suitable timber production lands, followed by **alternatives C and B**. These lands would be subject to periodic mechanical entries over time, although only one entry may occur during the planning period. Potential long-term negative environmental consequences to water quality, riparian areas, and aquatic habitats could result from higher road densities and the associated watershed and hydrologic impacts from repeated entries.

Alternative D has no lands suitable for timber production. In terms of wildland fire-only treatments, **alternatives A, B, and C** would potentially treat the least acres; therefore, they would likely result in the fewest beneficial impacts. **Alternative D** would result in the most beneficial impacts, as it could treat 22 to 91 percent more acres within each fish species drainage area than **alternatives A, B, and C**. Wildland fire only treatments require fewer ground-disturbing impacts and infrastructure (e.g., roads, landings) than mechanical treatments and can reduce the potential for future wildfires. Wildfires can negatively impact watershed conditions, riparian areas, aquatic habitats, and fish populations through uncharacteristic amounts of moderate and high severity fire activity.

Impacts Associated with Management Area Allocations

The fish species drainage areas are located in a variety of management areas. It is assumed that certain management areas have a higher probability of management activities, including ground-disturbing activities.

For the **action alternatives**, these management areas include General Forest, Community-Forest Intermix, High Use Developed Recreation Area, Energy Corridor, and Wild Horse Territory. **Alternative A** includes the Sandrock, Escudilla Demonstration Area, Forest Land, Grassland, Riparian, and Woodland Management Areas. Table 21 displays the percent species drainage area acres that occur in these management areas.

Increases in management intensity that alters ecological processes (e.g., ground-disturbing activities) across the landscape may reduce the likelihood of restoring ecosystems and providing for ecological sustainability. Increased management intensity can alter watershed and hydrologic process and functions, provide greater risks and threats to riparian and aquatic habitats, and limit and degrade aquatic habitat conditions and resiliency.

Table 21. Percent of species drainage area that is located in management areas where actions, including ground-disturbing activities, are most likely to occur

Species Drainage Area	Alt. A	Alt. B	Alt. C	Alt. D
Apache trout	82%	70%	78%	69%
Bluehead sucker	93%	89%	92%	70%
Desert sucker	75%	35%	74%	30%
Gila chub	100%	30%	100%	13%
Gila trout	33%	26%	33%	24%
Little Colorado spinedace	94%	92%	93%	66%
LCR sucker	94%	93%	93%	57%
Loach minnow	72%	24%	69%	20%
Longfin dace	70%	18%	67%	13%
Razorback sucker	70%	17%	68%	12%
Roundtail chub	95%	70%	95%	55%
Sonora sucker	75%	35%	74%	30%
Spikedace	70%	17%	67%	12%
Average of All Drainage Areas	**79%**	**47%**	**77%**	**36%**

The fish species in **alternatives C and A** are at higher risk from potential management activities. **Alternatives D and B** would have the least risk. Treatments and activities associated with vegetation, fire, recreation, specials uses, livestock grazing, and the transportation system can impact watersheds, riparian areas, aquatic habitat, and fish species. While the extent and cumulative and collective impacts of future actions cannot be determined at this time, recognizing and minimizing these risks can help maintain existing conditions and reduce any potential negative environmental consequences.

Impacts Associated with Other Management Activities

Future activities would include project implementation related to multiple-use management and would occur over most of the Apache-Sitgreaves NFs. Activities likely to occur are recreation, livestock grazing, special use authorizations, motorized transportation, and watershed, riparian, and aquatic habitat restoration.

Recreation

Potential impacts associated with recreation activities would be similar across **alternatives A, B, and D**. **Alternative C** impacts would be greater because of its emphasis on motorized and developed recreation opportunities. Water plays a critical role in many aspects of recreation on the Apache-Sitgreaves NFs. Lakes and streams attract visitors to the forests. Recreation activities occur near or adjacent to ponds, lakes, streams, and riparian areas which could negatively impact these areas by reducing vegetation, increasing sedimentation, and altering water quality and aquatic habitat conditions. Increases in motorized recreation activities could have similar impacts, while increasing the potential to transfer or introduce nonnative species that can negatively impact riparian areas and aquatic habitat.

Many developed and dispersed recreation sites are located on or near lakes and streams. This use typically results in trampling and altering of riparian areas and stream banks, damage to riparian vegetation, and soil compaction. Resulting erosion and sedimentation can alter aquatic habitat and water quality. The risk of water pollution from human wastes, dishwashing, trash, fish cleaning, and livestock use can occur where recreationists congregate. These risks can be reduced by designing and locating recreation sites and trails away from riparian areas. Stream and drainage crossings must be minimized and routes should terminate a distance from water to avoid impacts to riparian areas and water quality.

Livestock Grazing

Livestock grazing activities in uplands and riparian areas can have numerous impacts on the quality of aquatic resources and habitat. These impacts can be substantial and are a primary source of hydrologic alteration of watersheds, sedimentation, nutrient loading, changes to water quality, and fish habitat alteration and destruction.

The management strategy for livestock grazing does not vary by alternative; therefore, **all alternatives** would have similar impacts to hydrologic conditions, riparian vegetation, streambank conditions, and aquatic habitat within the allotments on the Apache-Sitgreaves NFs. Livestock also could introduce nonnative species, especially into riparian areas. The introduction of some nonnative plant species can displace native species, resulting in the loss of habitat diversity and alterations to the physical and biological components of the aquatic ecosystem.

Special Uses

Special uses for the occupancy and use of NFS lands for both private and public purposes occur through the issuance of special use authorizations and easements. Under **all alternatives**, a range of uses may be permitted, including, but not limited to, water storage and transmission, electric transmission and distribution lines, communications sites, alternative and renewable energy generating facilities, research permits, outfitters and guides, recreation events, large group gatherings, collecting permits, recreation residences, and target ranges.

While most activities either currently exist or could occur within many management areas, based on the suitability analysis, the General Forest Management Area has the greatest potential for these types of actions to occur. Special use authorizations and easements are not likely to contribute any potential beneficial impacts to watersheds, riparian areas, or aquatic habitats and the native species present. Many of these activities are long term and many result in permanent alterations and impacts to various resources where they occur.

Dams and diversions can have substantial impacts to riparian areas and aquatic species, while providing beneficial impacts to undesirable nonnative species. Outfitters and guides, research permits, and road easement special uses may occur within or adjacent to riparian areas and aquatic habitats and, depending on the activity, may negatively impact these areas and alter riparian and aquatic habitat conditions through ground disturbance, sedimentation, vegetation alteration and removals, and impacts to water quality. Many of these activities are conducive to promoting or spreading invasive plant species, especially those occurring within utility corridors, rights-of-way or easements, and riparian areas.

Motorized Routes

Generally, new road construction may occur when access to a particular resource or private inholding is needed. These roads may be permanent, if intended for long-term use, or they may be temporary for a one-time use and then removed. Less than 10 miles of new NFS road has been constructed over the past 5 years. It has been limited to relocation of poorly located roads (e.g., routes located in or near riparian areas, wet meadows) and developed campground construction. Temporary roads are used for forest product extraction where a permanent road is not needed for future access.

All alternatives would include the continued use and maintenance of the existing motorized road and trail systems. The existing systems currently impact riparian and aquatic ecosystems through erosion, sedimentation, changes to channel morphology and, to some extent, the movement of fish and other aquatic organisms. This infrastructure and its continued use may be the primary source of impacts to riparian and aquatic resources. However, **all alternatives** include objectives, standards, and guidelines to reduce impacts over time and to reduce impacts from construction and maintenance of motorized routes. Road and trail systems may contribute to the introduction of invasive species—either aquatic or terrestrial plant species—by providing access to lakes, reservoirs, ponds, streams, and riparian areas. Stream crossings provide access for many types of recreation activities, which can increase the likelihood of introducing invasive plant, invertebrate, and fish species.

While none of the alternatives proposes to increase the transportation system, maintenance and reconstruction would occur in all alternatives. **Alternatives A, B, and C** could have the greatest potential to increase sedimentation, erosion, and alteration of hydrologic conditions due to their greater emphasis on mechanical vegetation treatments, commodity outputs, road maintenance and use, reconstruction, and temporary construction. **Alternative D** could result in the least amount of impacts associated with road reconstruction, temporary roads, and skid trail construction because it emphasizes wildland fire treatments rather than mechanical treatments.

Watershed/Riparian/Aquatic Habitat Restoration

Watershed and riparian restoration objectives vary by alternative (see table 3 Type, Priority, and Amount of Restoration Treatments in chapter 2). Although all watershed treatments could improve conditions for aquatic species and their habitats, restoration treatments within the riparian areas and aquatic habitats could result in the most beneficial impacts. Beneficial impacts should reduce sedimentation, improve riparian vegetation conditions, and increase the productivity of aquatic habitat. As **alternative D** has the most treatments, it would result in the most benefits to aquatic habitat, followed by **alternatives B, C, and A**.

Impacts Associated with Nonnative Fish Species

The presence of nonnative fish species has resulted in impacts (e.g., competition, predation, hybridization, habitat alteration) across the Apache-Sitgreaves NFs. The harmful interactions are well documented (e.g., recovery plans) and a primary cause of the current declining status of federally listed and sensitive fish species throughout the Southwest. Approximately 24 nonnative fish species occur within or adjacent to the Apache-Sitgreaves NFs. The deliberate or unintentional introductions of amphibians, invertebrates (e.g., crayfish, snails, clams, mussels), parasites and diseases, and aquatic invasive plants have also impacted aquatic communities and habitats.

The potential impacts from nonnative fish would be similar across **alternatives A, B, and D. Alternative C** impacts would be greater because of greater access and increased developed and motorized recreation opportunities. Roads and trails can contribute to the introduction of invasive species, either aquatic or terrestrial, by providing access to ponds, lakes, streams, and riparian areas. Boats and boat trailers are a primary source of lake introductions while river and stream crossings provide recreation and angler access that can also increase the potential for introduction of nonnative fish, mollusks, crayfish, diseases, and parasites.

While watershed, riparian, and aquatic habitat restoration treatments are necessary and beneficial, they must consider the potential to increase the spread of invasive species by providing increased connectivity and altering habitat. Improvement in habitat conditions may benefit some nonnative species, as well as native species. These interactions and interrelationships would also be considered when implementing restoration treatments.

Cumulative Environmental Consequences

The analysis area for fisheries cumulative environmental consequences includes lands managed by the Apache-Sitgreaves NFs and lands of other ownership (e.g., State, tribal, private) within and adjacent to the Apache-Sitgreaves NFs. These other lands can also influence and impact the Apache-Sitgreaves NFs and their management, as discussed below.

Aquatic habitats are very unique and limited over the Apache-Sitgreaves NFs. Habitat alteration is the major cause of declines in native aquatic species. The most common physical habitat alterations are changes to stream channel and riparian vegetation, water impoundments (e.g., ponds, lakes), sedimentation and water quality changes, and streamflow changes. Additionally, other substantial human impacts include pollution, introduction and spread of invasive species and, for some fish species, overharvesting. Under **all alternatives**, aquatic habitat quality and quantity is determined and influenced by activities that occur within the watershed and can also be influenced and impacted by actions occurring on private lands within the Apache-Sitgreaves NFs and downstream outside the forests.

For example, fish stocking on adjacent lands and private inholdings (e.g., ponds, streams, reservoirs) continues to impact native fish species and their aquatic habitats on the Apache-Sitgreaves NFs. While providing extensive and highly desirable recreational fishing opportunities, AZGFD continue to impact native fish throughout the Apache-Sitgreaves NFs through stocking and management of nonnative fish. Populations of nonnative species (existing and those stocked) on the San Carlos and White Mountain Apache tribal lands also contribute to the spread and persistence of nonnative species and further degrade existing conditions for native fish species and aquatic habitats.

Private lands within and adjacent to the Apache-Sitgreaves NFs can influence watersheds and aquatic and riparian habitat in many ways. Urban development and the associated infrastructure can impact water quantity and quality from water diversions and consumptive use, groundwater pumping, and septic and sewer systems. Roads and utility infrastructure can also impact watersheds, water quality, and aquatic habitat and can increase the spread of invasive species. All of these activities occur to varying degrees across the Apache-Sitgreaves NFs and within communities adjacent to the forests, such as Alpine, Eagar, Heber, Forest Lakes, Show Low, and Springerville. In addition, numerous private inholdings, such as those on the Blue River and Eagle Creek, are located near riparian/aquatic corridors and have impacts similar to those discussed above.

Vegetation

This section describes and analyzes the 14 potential natural vegetation types (PNVTs) of the Apache-Sitgreaves NFs. All PNVT overstory structure and cover data is post-2011 Wallow Fire. Understory vegetation data is pre-Wallow Fire (2007 to 2008) and does not reflect the soil and understory vegetation acreage that was burned at moderate and high severity levels. Acreage within each PNVT is static, because it is based on a combination of several factors such as topography, elevation, aspect, soil type, soil moisture and temperature, ambient air temperature, and associated biotic influences. However, the acreage within each PNVT overstory structural state may vary over time because of natural succession, management treatments, and other disturbance factors.

This section quantifies the extent each PNVT’s overstory structure, size class, and canopy cover have departed from desired conditions using the measure of departure index (DI). It then predicts what the departure and trend would be after implementing the vegetation treatment objectives in each alternative. It discusses the threats and risks that have caused departures from desired conditions and may hinder progress toward desired conditions. This section also examines the state of aspen on the forests by estimating current acres and potential reduction in the amount by alternative. The section also describes the relationship between overstory canopy and the condition of the herbaceous understory vegetation using the amount (acres) of closed canopy cover, as well as ecological range condition.

See the “Vegetation Specialist Report” (Forest Service, 2014t) in the “Plan Set of Documents” for more in-depth discussion of these topics. The specialist report also discusses the relationship between current PNVTs on the forests, their reference condition, and the Apache-Sitgreaves NFs ecological contribution to the larger ecoregion.

Projected trends in the movement of vegetation between states (or transitions) were derived through use of the Vegetation Dynamics Development Tool (VDDT)[21]. The following PNVTs were modeled using VDDT software: ponderosa pine, dry mixed conifer, wet mixed conifer, and spruce-fir forests; Madrean pine-oak and piñon-juniper woodlands; Great Basin and semi-desert grasslands; and interior chaparral. State and transition modeling was not conducted for montane/subalpine grasslands and the four riparian PNVTs. Additional information about the vegetative modeling methodology can be found in appendix B.

In most cases, desired conditions and reference conditions are the same. However, they are not for 5 of the 14 PNVTs. In ponderosa pine and dry mixed conifer forests the desired conditions reflect contemporary landscape vegetation structural states important to northern goshawks and Mexican spotted owls. In Madrean pine-oak woodland the desired conditions reflect contemporary landscape vegetation structural states important to Mexican spotted owls. Desired conditions are also different from reference conditions for the wet mixed conifer and spruce-fir forests to reflect areas absent the succession of aspen cover types, where even-aged conifer succession predominates. As an expression of socioeconomic sustainability, a minor percentage of areas without aspen cover types would be managed on shorter rotations than the historic stand replacement intervals (120 years versus 200+ years). These desired conditions have somewhat higher proportions of early successional vegetation structural states than reference conditions, proportions of mid-successional vegetation structural states that are somewhat lower than reference conditions, and proportions of late successional vegetation structural states that are somewhat lower than reference conditions.

The departure index (DI) is a rating based on departure from desired vegetation conditions. Determination of the amount of departure is based on comparisons of forest structure, size class, and canopy cover. DI classes include the following:

- **No departure** (0 to 20 percent): Composition and structure of overstory vegetation is similar to desired conditions and the risk of losing key ecosystem components (e.g., native species, forest structure, soil) is minimal. Areas within this DI class can be maintained within their historical fire regime by such treatments as fire.
- **Low departure** (21 to 40 percent): Composition and structure of overstory vegetation is somewhat altered from desired conditions and the risk of losing key ecosystem components is low. Areas within this DI class may need some level of restoration treatments (e.g., fire, mechanical) to be restored to reference conditions.
- **Moderate departure** (41 to 60 percent): Composition and structure of overstory vegetation is moderately altered from desired conditions and the risk of losing key ecosystem components is moderate. Areas within this DI class may need moderate levels of restoration treatments (e.g., fire, mechanical) to be restored to reference conditions.
- **High departure** (61 to 80 percent): Composition and structure of overstory vegetation is highly altered from desired conditions and the risk of losing key ecosystem components is high. Areas within this DI class may need greater levels of restoration treatments (e.g., fire, mechanical) to be restored to reference conditions.

[21] VDDT software is a nonspatial model that allows the user to model vegetation change over time as a series of states that differ in structure, composition, and cover. VDDT also specifies the amount of time it takes to move from one vegetation state to another in the absence of disturbance. VDDT Version 6.0.25 was used for this analysis.

- **Severe departure** (81 to 100 percent): Composition and structure of overstory vegetation is extremely altered from desired conditions and the risk of losing key ecosystem components is pronounced. Areas within this DI class may need very high levels of restoration treatments (e.g., fire, mechanical) to be restored to reference conditions.

In the analysis for this resource, assumptions include the following:

- Because overstory vegetation desired conditions have been identified at or near reference conditions, the closer the composition, structure, and processes of an individual PNVT are to desired conditions the more properly the PNVT is functioning.
- Restoration will reestablish more natural patterns and processes within these vegetation communities that allow for natural resiliency. This is especially important when faced with potential changes in climate, uncharacteristic wildfire, and the presence of invasive plant species.

Affected Environment

Potential Natural Vegetation Types

Potential natural vegetation types (PNVTs) are coarse-scale groupings of ecosystem types that share similar geography, vegetation, and historic ecosystem disturbances, such as fire, drought, and grazing by native species. PNVTs represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail (Vander Lee et al., 2006). Tables 22 and 23 display the major PNVTs (Vander Lee et al., 2006) found on the Apache-Sitgreaves NFs. Maps displaying the spatial distribution of all PNVTs across the forests are located in appendix J.

Table 22. The 14 potential natural vegetation types (PNVTs) of the Apache-Sitgreaves NFs

Forests	Woodlands	Grasslands	Chaparral	Riparian Areas/ Riparian Forests
ponderosa pine	Madrean pine-oak	Great Basin	interior	wetland/cienega
wet mixed conifer	piñon-juniper	semi-desert		cottonwood-willow
dry mixed conifer		montane/subalpine		mixed broadleaf deciduous
spruce-fir				montane willow

Table 23. Acres and percent of the forests by PNVT, listed from largest to smallest

PNVT	Acres of NFS Land	Percent of NFS Land
Ponderosa Pine Forest	602,206	29.9%
Madrean Pine-Oak Woodland	394,927	19.6%
Piñon-Juniper Woodland	222,166	11.0%
Great Basin Grassland	185,523	9.2%
Wet Mixed Conifer Forest	177,995	8.8%
Dry Mixed Conifer Forest	147,885	7.3%
Semi-desert Grassland	106,952	5.3%
Interior Chaparral	55,981	2.8%
Montane/Subalpine Grasslands	51,559	2.6%
Wetland/Cienega Riparian Areas	17,900	0.9%
Spruce-Fir Forest	17,667	0.9%
Cottonwood-Willow Riparian Forest	15,876	0.8%
Mixed Broadleaf Deciduous Riparian Forest	9,657	0.5%
Montane Willow Riparian Forest	4,808	0.2%

Table 24 lists the current departure index (DI), a comparison between the existing overstory vegetation conditions and the desired conditions, for each PNVT.

Table 24. Potential natural vegetation types (PNVT) and current overstory departure (DI) percent from desired conditions

No Departure (0–20 percent)		Low Departure (21–40 percent)		Moderate Departure (41–60 percent)		High Departure (61–80 percent)	
PNVT	DI	PNVT	DI	PNVT	DI	PNVT	DI
cottonwood-willow riparian forest	20	wetland/ cienega riparian areas	36	spruce-fir forest	59	semi-desert grassland	79
interior chaparral	8	mixed broadleaf deciduous riparian forest	33	montane/ subalpine grasslands	54	ponderosa pine forest	77
		piñon-juniper woodland	26	wet mixed conifer forest	54	Great Basin grassland	67
		montane willow riparian forest	21			dry mixed conifer forest	67
						Madrean pine-oak woodland	61

The following sections describe the setting, current DI, forest overstory structure, size class, canopy cover, and threats to the PNVT. More detailed descriptions of each PNVT, including species composition, can be found in the proposed plan. For information on the fire regime and fire regime condition class (FRCC) for each PNVT, see the "Fire" section in chapter 3. See appendix B in the proposed plan for PNVT graphs that depict current and desired vegetation structural states.

Forested PNVTs – Ponderosa Pine

The ponderosa pine forest is widespread (figure 13) and represents the largest PNVT and the largest forested PNVT. Current conditions within the ponderosa pine forest are highly departed from desired conditions. With a DI of 77, this PNVT is the second most departed PNVT from desired conditions.

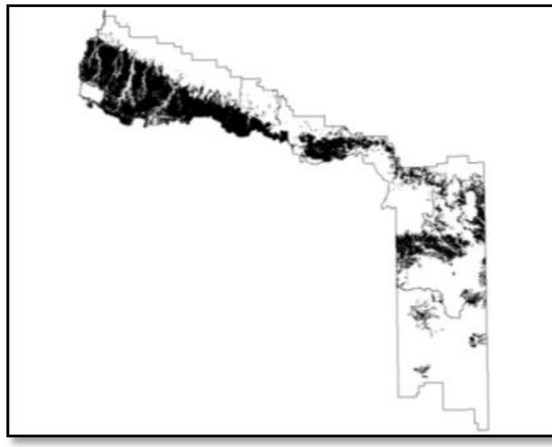

Figure 13. Location map of ponderosa pine forest

With respect to DI, there is considerable over representation (56 percent) of all size and age trees, single-storied or multistoried with closed canopy cover. There is also an atypical early developmental state (11 percent) that was created by uncharacteristic wildfire. Historically, this forested PNVT was characterized by open canopies, but currently there is an under representation (58 percent) of medium to very large size, single-storied or multistoried trees with open canopy cover. Historically, these forests were dominated by shade intolerant shrub and tree species and had a diverse herbaceous understory.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (94 percent of the total PNVT's area) associated with the ponderosa pine forest; approximately 98 percent of the herbaceous understory is in low to moderately-high ecological status[23]; while only 2 percent is in high ecological status. Declines in ecological status

[22] Grazing capability is a qualitative expression of the inherent ability of an ecosystem to support grazing use by various classes of livestock on a sustained yield basis; that is, maintaining the stability and productivity of the site. Soil stability determinations and site productivity evaluations are used in combination to determine and assign grazing capability. Capable areas are those which can be used by grazing animals under proper management without long-term damage to the soil resource or plant communities. Typically, this land is stable. Vegetative ground cover is maintaining site productivity and producing a minimum of 100 pounds of dried forage per acre per year. Soil loss as judged by available techniques is within tolerance (Forest Service, 2013). Because areas classified as having no grazing capability are not allocated for livestock grazing they are not usually evaluated for range condition and ecological status, therefore this information is generally not collected from these areas and is unavailable or incomplete. In addition, other resource program areas do not generally collect this type of data as well, so again, this type of information is not available outside of capable grazing areas.

[23] Ecological status is the degree of similarity or dissimilarity (i.e., departure) between the existing vegetation (all components and their characteristics) and existing soil conditions when compared to the potential natural plant community and the desired soil condition on a site. The present state of a TES map unit stated in terms of specific values or potentials with respect to species composition, ground cover, and soil characteristics. (Forest Service, 2013). Ecological status ratings are: high, moderately-high, moderate-low, and low (FSH 2209.21. R3) departure from the potential natural plant community.

have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional changes and possible changes in site potential. The majority of the herbaceous understory vegetation within the ponderosa pine forest capable grazing lands is moderately to severely departed from desired conditions.

The most important and far-reaching threats under Forest Service authority that have affected this forested PNVT include past livestock grazing which removed fine fuels needed for carrying frequent, low intensity surface fires; forest management practices (vegetation treatments) which changed forest age class distribution, composition, density, and cover and greatly reduced understory productivity; and fire suppression which effectively ended the frequent fire regime typical of this forested PNVT.

Forested PNVTs – Wet Mixed Conifer

The wet mixed conifer forest is found primarily on the Alpine, Black Mesa, and Springerville Ranger Districts (figure 14) and is the second largest forested PNVT. Current conditions within the wet mixed conifer forest are moderately departed from desired condition. The current DI is 54 percent.

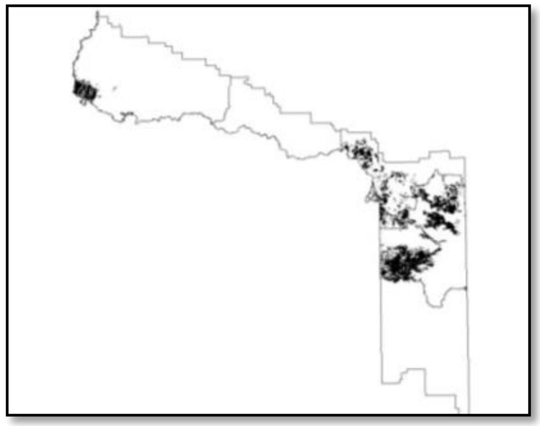

Figure 14. Location map of wet mixed conifer forest

With respect to DI, there is an over representation (37 percent) of vegetation structural states that are lacking or have limited aspen regeneration due to elk browsing and an under representation (38 percent) of large to very large size, single-storied or multistoried trees with closed canopy cover. Historically, these forests were dominated by shade tolerant shrub and tree species and had a diverse herbaceous understory.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable grazing lands (45 percent of the total PNVT's area) associated with the wet mixed conifer forest; approximately 96 percent of the herbaceous understory is in low to moderately-high ecological status; while only 4 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional changes, and possible changes in site potential. The majority of the herbaceous understory vegetation within the wet mixed conifer forest capable grazing lands is moderately to severely departed from desired conditions.

The most important and far-reaching threats under Forest Service authority that have affected this forested PNVT are human-caused fires and forest management practices (vegetation treatments) which changed forest age class distribution, composition, density, and cover.

Forested PNVTs – Dry Mixed Conifer

The dry mixed conifer forest is widespread, found primarily on the Alpine, Black Mesa, and Springerville Ranger Districts (figure 15). Current conditions within the dry mixed conifer forest are highly departed from desired conditions. The current DI is 67 percent.

With respect to DI, there is an over representation (56 percent) of all size and age trees, single-storied or multistoried with closed canopy cover. In addition, there is an atypical early developmental state created by uncharacteristic wildfire (25 percent). Historically, this forested PNVT was characterized by open canopies, but currently there is an under representation (52 percent) of medium to very large size, single-storied or multistoried trees with open canopy cover. Historically, these forests were dominated by shade intolerant shrub and tree species and had a diverse herbaceous understory.

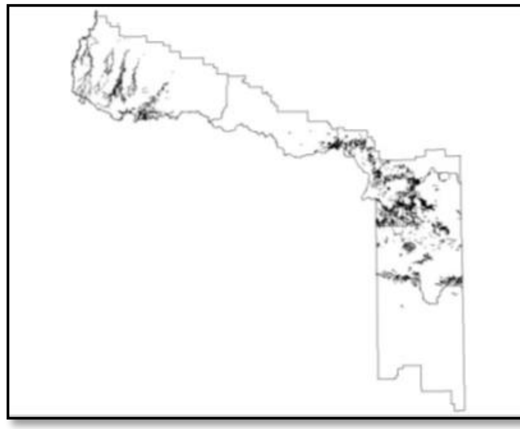

Figure 15. Location map of dry mixed conifer forest

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable grazing lands (71 percent of the total PNVT's area) associated with the dry mixed conifer forest; approximately 97 percent of the herbaceous understory is in low to moderately-high ecological status; while only 3 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the understory within the dry mixed conifer forest capable grazing lands is moderately to severely departed from desired conditions.

The threats to dry mixed conifer are the same as those listed for ponderosa pine.

Forested PNVTs – Spruce-Fir

The spruce-fir forest is found on the Alpine and Springerville Ranger Districts (figure 16). It is the smallest of the forested PNVTs. Current conditions within the spruce-fir forest are moderately departed from desired condition. The current DI is 59 percent.

With respect to DI, there is an over representation (29 percent) of vegetation structural states that are lacking or have limited aspen regeneration due to elk browsing. There is an under representation (43 percent) of large to very large size trees, single-storied or multistoried with closed canopies. Historically, these forests were dominated by shade tolerant shrub and tree species and had a diverse herbaceous understory.

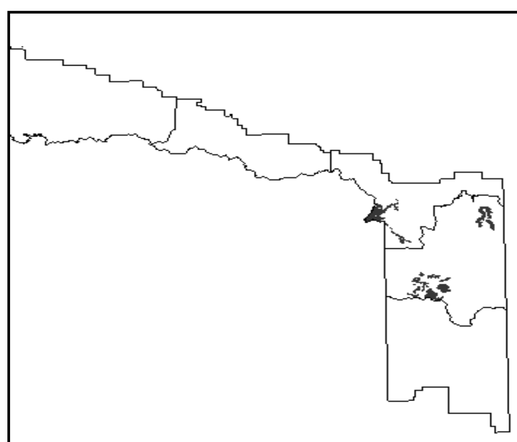

Figure 16. Location map of spruce-fir forest

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicates that within the capable grazing lands (12 percent of the total PNVT's area) associated with the spruce-fir forest; approximately 55 percent of the herbaceous understory is in high ecological status[23]; while 45 percent is in moderately-low to moderately-high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. However, the majority of the herbaceous understory vegetation within the spruce-fir forest capable grazing lands has low or no departure from desired conditions.

The threats to spruce-fir are the same as those listed for wet mixed conifer.

Woodland PNVTs – Madrean Pine-Oak

The Madrean pine-oak woodland is found primarily below the Mogollon Rim on the Alpine and Clifton Ranger Districts (figure 17). It is the largest of the woodland PNVTs and the second largest PNVT. Current conditions within the Madrean pine-oak woodland are highly departed from desired conditions. The current DI is 61 percent.

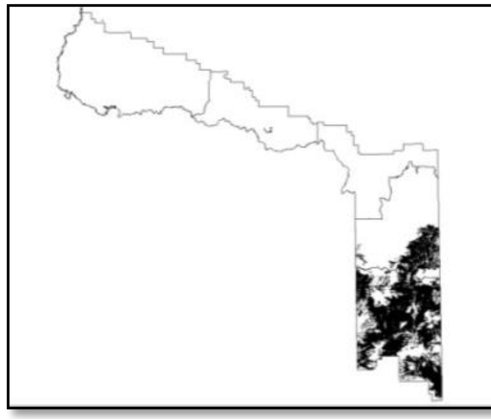

Figure 17. Location map of Madrean pine-oak woodland

With respect to DI, there is an over representation (59 percent) of small to very large size trees with closed canopy cover. Historically, this woodland PNVT was characterized by open canopies which are now reflected in an under representation (60 percent) of seedling, saplings, small, and medium to very large size, single-storied or multistoried trees with open canopy cover. Historically, these woodlands were dominated by shade intolerant shrub and tree species and had a diverse herbaceous understory.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (46 percent of the total PNVT's area) associated with the Madrean pine-oak woodland; approximately 84 percent of the herbaceous understory is in low to moderately-high ecological status; while 16 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the understory within the Madrean pine-oak woodland capable grazing lands is moderately to severely departed from desired conditions.

The most important and far-reaching threats under Forest Service authority that have affected the Madrean pine-oak woodland include past livestock grazing which removed fine fuels needed for carrying frequent, low intensity surface fires; forest management practices which changed age class distribution, composition, density, and cover and greatly reduced understory productivity; fire suppression which effectively ended the frequent fire regime typical of this woodland; and the introduction of invasive plants.

Woodland PNVTs – Piñon-Juniper

The piñon-juniper woodland occurs primarily along the forests' northern boundary on the Black Mesa, Lakeside, Springerville, and Alpine Ranger Districts (figure 18). It represents the third largest PNVT. Current conditions within the piñon-juniper woodland are at a low departure from desired conditions with a DI of 26 percent.

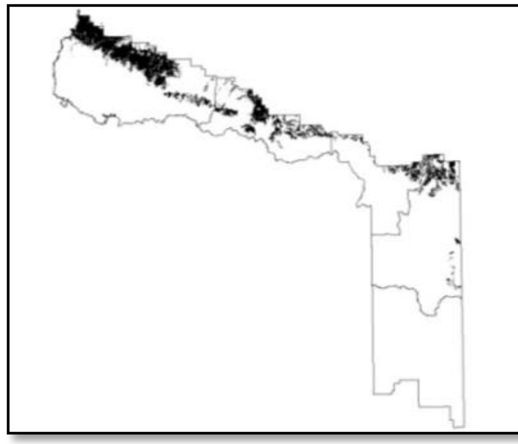

Figure 18. Location map of piñon-juniper woodland

With respect to DI, there is an over representation (19 percent) of medium to very large size trees with open canopy cover and an under representation (25 percent) of early successional, seedlings, saplings, and small size trees with open canopy cover. Historically, these woodlands were dominated by shade intolerant shrub and tree species and had a diverse herbaceous understory.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (96 percent of the total PNVT's area) associated with the piñon-juniper woodland; approximately 98 percent of the herbaceous understory is in low to moderately-high ecological status; while only 2 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the piñon-juniper woodland capable grazing lands is moderately to severely departed from desired conditions.

The threats to piñon-juniper are the same as those listed for Madrean pine-oak.

Grassland PNVTs – Great Basin

The Great Basin grassland occurs primarily along the forests' northern boundary on the Black Mesa, Lakeside, Springerville, and Alpine Ranger Districts; it is closely associated with piñon-juniper woodland (figure 19). It is the largest of the grassland PNVTs and the fourth largest PNVT. Current conditions within the Great Basin grassland are highly departed from desired conditions with a DI of 67 percent.

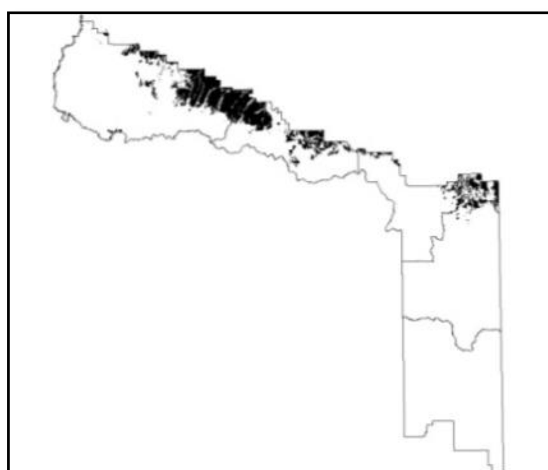

Figure 19. Location map of Great Basin grassland

With respect to DI, there is an over representation (66 percent) of encroaching shrubs and trees of all sizes with open and closed canopies and an under representation (63 percent) of open, dense stands of perennial grasses and forbs with less than 10 percent woody canopy cover. There is also an uncharacteristic state where various noxious weeds and invasive plants makeup a significant portion of the vegetation composition.

Currently, much of this grassland more closely resembles woodland than grassland. Approximately 68 percent, or nearly 126,200 acres, of this grassland have been encroached by woody species, primarily piñon and juniper and no longer have the appearance of a grassland community. According to Vander Lee et al. (2006) approximately 70 percent of these encroached acres may be non-restorable to their former grassland state. Historically, these grasslands were dominated by a diverse herbaceous vegetation community.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (99 percent of the total PNVT's area) associated with the Great Basin grassland; approximately 97 percent of the herbaceous understory is in low to moderately-high ecological status; while only 3 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the Great Basin grassland capable grazing lands is moderately to severely departed from desired conditions.

The most important threats under Forest Service authority that have affected this grassland include fire suppression which effectively ended the frequent fire regime typical of this grassland, woody species encroachment and establishment, human-caused fires and roads, highways and energy corridors, livestock grazing, and invasive plants. These threats result in modification of natural processes and habitats which have negative consequences to ecological composition, structure, function, and processes.

According to Gori and Enquist (2003), changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey, 1995). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock, prairie dog eradication, exotic grasses, shrub encroachment, erosion, and habitat fragmentation.

Grassland PNVTs – Semi-Desert

This grassland occurs primarily on the Clifton Ranger District closely associated with the Madrean pine-oak woodland (figure 20). Current conditions within the semi-desert grassland are highly departed from desired conditions with a DI of 79 percent; this PNVT is the most departed from desired conditions.

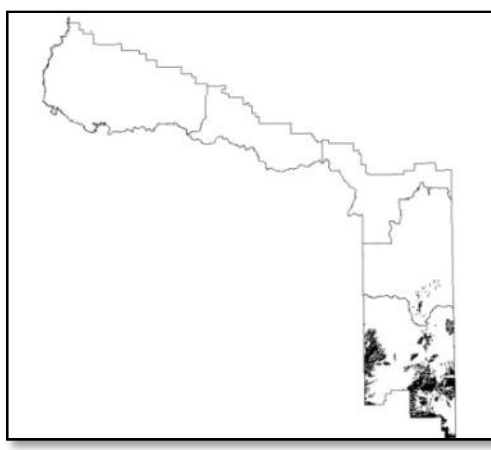

Figure 20. Location map of semi-desert grassland

With respect to DI, there is an over representation (77 percent) of encroaching shrubs and trees of all sizes with open and closed canopies and an under representation (81 percent) of open, dense stands of perennial grasses and forbs (late seral) with less than 10 percent woody canopy cover. There is also an uncharacteristic state where various noxious weeds and invasive plants make up a significant portion of the vegetation composition.

Currently, much of this grassland more closely resembles woodland than grassland. Approximately 80 percent, or nearly 85,600 acres, of this PNVT has been encroached by woody species, primarily juniper and mesquite and no longer have the appearance of a grassland community. According to Vander Lee et al. (2006) approximately 36 percent of these encroached acres may be non-restorable to their former grassland state. Historically, these grasslands were dominated by a diverse herbaceous vegetation community.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (80 percent of the total PNVT's area) associated with the semi-desert grassland; approximately 82 percent of the herbaceous understory is in low to moderately-high ecological status; while 18 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the semi-desert grassland capable grazing lands is moderately to severely departed from desired conditions.

The threats to semi-desert grassland are the same as those listed for Great Basin grassland.

Grassland PNVTs – Montane/Subalpine

This grassland occurs primarily on the Alpine and Springerville Ranger Districts (figure 21). It is the smallest of the grassland types. Current conditions within the montane/subalpine grasslands are moderately departed from desired conditions with a DI of 54 percent.

With respect to DI, there is an over representation (50 percent) of mid-development (mid-seral), open canopy (herbaceous vegetation), encroaching shrubs and trees of all sizes with open and closed canopies, and an under representation (41 percent) of late development (late seral), open canopy (herbaceous vegetation). There is also an uncharacteristic state where various noxious weeds and invasive plants make up a significant portion of the vegetation composition. Approximately 10 percent or nearly 5,200 acres of this PNVT have been encroached by woody species, primarily mixed conifer, ponderosa pine, and piñon-juniper (depending on elevation and slope aspect).

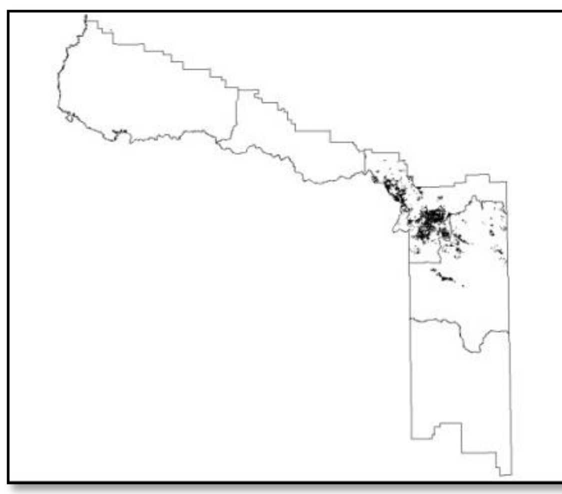

Figure 21. Location map of montane/subalpine grassland

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (99 percent of the total PNVT's area) associated with the montane/subalpine grasslands; approximately 82 percent of the herbaceous understory is in low to moderately-high ecological status; while 12 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the montane/subalpine grasslands capable grazing lands is moderately to severely departed from desired conditions.

The threats to montane/subalpine grasslands are the same as those listed for Great Basin grassland.

Chaparral PNVT – Interior Chaparral

Interior chaparral occurs primarily on the Clifton Ranger District (figure 22).

Current conditions within interior chaparral are not departed from desired condition with a DI of 8 percent. With respect to DI, there is a small over representation (8 percent) of early development (early seral) open canopy herbaceous dominated conditions in a historically shrub dominated PNVT.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (44 percent of the total PNVT's area) associated with the interior chaparral; approximately 88 percent of the herbaceous understory is in moderately-low to moderately-high ecological status; while 12 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the interior chaparral capable grazing lands is moderately to highly departed from desired conditions.

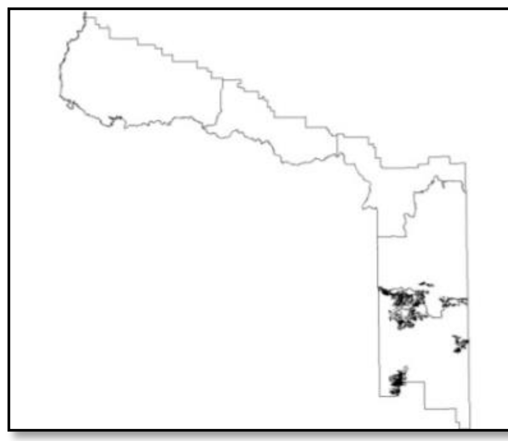

Figure 22. Location map of interior chaparral

The most important and far-reaching threats under Forest Service authority that have affected interior chaparral are human-caused fires, invasive species establishment, inappropriate livestock grazing, and loss of soil and soil productivity.

Riparian PNVTs

Riparian areas are of primary importance because of the scarcity of water in the Southwest. All riparian PNVTs are unique in that they represent a very small portion (less than 3 percent) of the Apache-Sitgreaves NFs. However, the Apache-Sitgreaves NFs are responsible for management of the majority of this type within the ecoregion. These areas on the Apache-Sitgreaves NFs are a focal point for humans, terrestrial wildlife, and livestock activities, as well as species that are dependent on wetland, riparian, and aquatic habitats. Therefore, both demand and impacts are high. For more information about the condition of riparian areas, see the "Riparian" section in chapter 3.

Riparian PNVTs – Wetland/Cienega

Wetland/cienega riparian areas occur primarily on the Alpine and Springerville Ranger Districts (figure 23). This PNVT is associated with perennial springs or headwater streams, bogs, and fens where groundwater intersects the surface and creates pools of standing water, sometimes with channels flowing between pools.

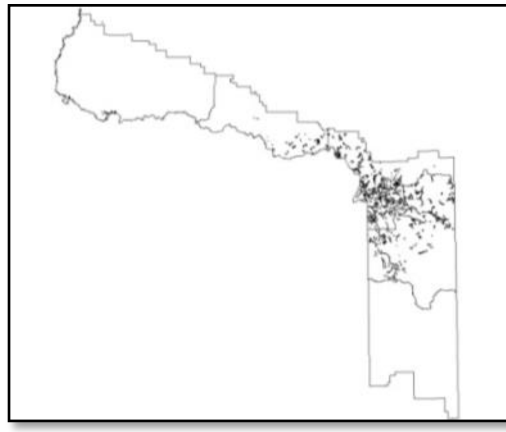

Figure 23. Location map of wetland/cienega riparian areas

Current conditions within wetland/cienega riparian areas have a low departure from desired conditions with a DI of 36 percent. With respect to DI, there is an under representation (27 percent) of mid-development (mid-seral), open canopy (herbaceous vegetation) and an over representation (37 percent) of encroaching shrubs and trees with open and closed canopies. Historically, these riparian areas were dominated by herbaceous vegetation.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (94 percent of the total PNVT's area) associated with wetland/cienega riparian areas; approximately 92 percent of the herbaceous understory is in low to moderately-high ecological status; while only 8 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the wetland/cienega riparian areas capable grazing lands is moderately to severely departed from desired conditions.

Changes in the structure and function of wetland/cienega systems have been noted as the primary cause of the loss of biological diversity within these systems. The causes of adverse change in the ecological character of wetland/cienegas can be grouped in five broad categories: (1) changes to the water regime, (2) water pollution, (3) physical modification, (4) exploitation of biological products, and (5) introduction of invasive species (Bodner and Simms, 2008).

The most important threats under Forest Service management authority that have affected the riparian areas and riparian forested PNVTs include fire suppression, which has allowed non-riparian species expansion into these communities; inundation (e.g., diversions, dams, and impoundments) and drying of the riparian communities below the impoundment and concurrently flooding those communities above the impoundment; human-caused fires; roads, highways, and corridors; inappropriate livestock grazing; and wild ungulates. These threat types include natural process modification and habitat conversion which have negative consequences to ecological composition, structure, function, and processes.

Riparian PNVTs – Cottonwood-Willow

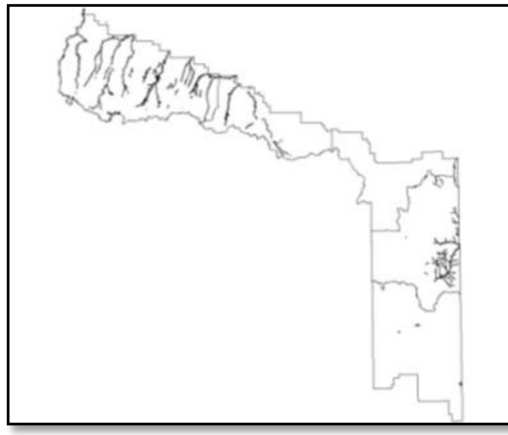

Figure 24. Location map of cottonwood-willow riparian forest

This riparian forest occurs primarily on the Alpine, Black Mesa, and Lakeside Ranger Districts along approximately 800 miles of rivers and streams (figure 24). Current conditions within the cottonwood-willow riparian forest are not departed from desired conditions with a DI of 20 percent.

With respect to DI, there is an under representation (20 percent) of small size trees with open and closed canopies and an over representation (16 percent) of medium to very large size trees with open and closed canopies. These conditions are indicative of an older stand structure which lacks young tree recruitment. Historically, these forests were dominated by shade intolerant shrub and tree species with open canopies allowing for an abundance of herbaceous species.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (97 percent of the total PNVT's area) associated with the cottonwood-willow riparian forest; approximately 96 percent of the herbaceous understory is in low to moderately-high ecological status; while only 4 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the cottonwood-willow riparian forest capable grazing lands is moderately to severely departed from desired conditions.

The threats to cottonwood-willow riparian forest are the same as those listed for wetland/cienega riparian areas.

Riparian PNVTs – Mixed Broadleaf Deciduous

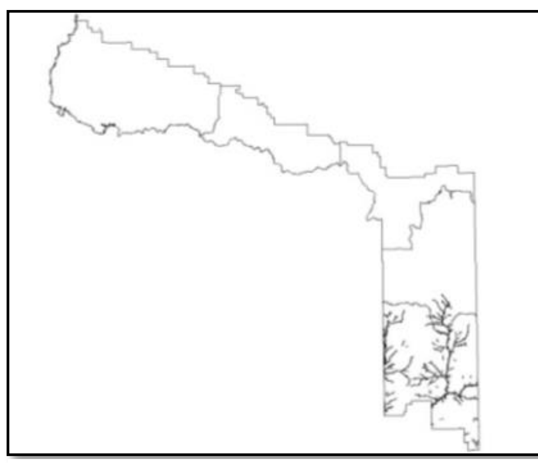

Figure 25. Location map of mixed broadleaf deciduous forest

This riparian forest occurs primarily on the Alpine and Clifton Ranger Districts along approximately 860 miles of rivers and streams (figure 25). Current conditions within the mixed broadleaf deciduous riparian forest are at a low departure from desired conditions with a DI of 33 percent.

With respect to DI, there is an over representation (31 percent) of seedlings, saplings, and small to medium size trees with closed canopies and an under representation (29 percent) of seedlings, saplings, and small to very large size trees with open canopies. Historically, these forests were dominated by shade intolerant to very shade intolerant shrub and tree species with open canopies allowing for an abundance of herbaceous species.

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (85 percent of the total PNVT's area) associated with the mixed broadleaf deciduous riparian forest; approximately 75 percent of the herbaceous understory is in low to moderately-high ecological status; while 25 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the mixed broadleaf deciduous riparian forest capable grazing lands is moderately to severely departed from desired conditions.

The threats to mixed broadleaf deciduous riparian forest are the same as those listed for wetland/cienega riparian areas.

Riparian PNVTs – Montane Willow

This riparian forest occurs primarily on the Alpine, Black Mesa, and Springerville Ranger Districts along approximately 1,130 miles of rivers and streams (figure 26). It represents the smallest PNVT on the Apache-Sitgreaves NFs. Current conditions within the montane willow riparian forest are at a low departure from desired conditions with a DI of 21 percent.

With respect to DI, there is an over representation (21 percent) of seedlings, saplings, and small to very large size trees with open and closed canopies and an under representation (21 percent) of herbaceous vegetation, seedlings, and saplings with open canopies. Historically, these forests were dominated by shade intolerant shrub and tree species with open canopies allowing for an abundance of herbaceous species.

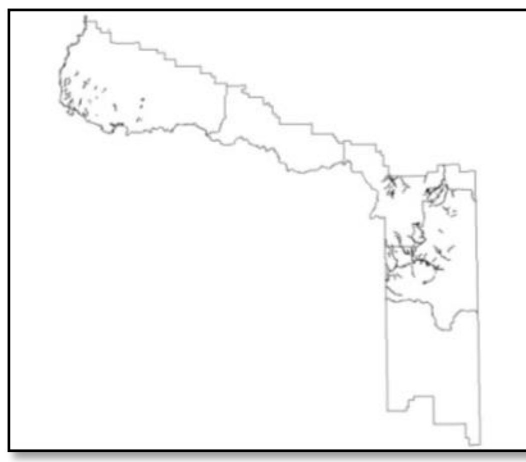

Figure 26. Location map of montane willow riparian forest

The most current Apache-Sitgreaves NFs data (Forest Service, 2007c) indicate that within the capable[22] grazing lands (85 percent of the total PNVT's area) associated with the montane willow riparian forest; approximately 92 percent of the herbaceous understory is in low to moderately-high ecological status; while only 8 percent is in high ecological status. Declines in ecological status have resulted in lower levels of herbaceous vegetation ground cover and lower levels of plant vigor and growth, as well as species compositional shifts, and possible changes in site potential. The majority of the herbaceous understory vegetation within the montane willow riparian forest capable grazing lands is moderately to severely departed from desired conditions.

The threats to montane willow riparian forest are the same as those listed for wetland/cienega riparian areas.

Threats and Risks to PNVTs

The threats to the forests' PNVTs, mentioned above in each PNVT discussion, pose the following risks. Many of these risks, when combined, have compounding effects with negative consequences to ecological composition, structure, function, and processes, specifically by affecting the following:

- vegetation health (e.g., resulting in atypical composition, structure, and function of both the overstory and understory vegetation);
- soil compaction, erosion, sedimentation, and loss of soil fertility;
- altered watershed and hydrologic functions;
- reduced water quality and quantity;
- riparian, aquatic, and terrestrial site loss and/or degradation and fragmentation of these habitats within these PNVTs;
- altered fire regimes, uncharacteristic wildfire, and inability to reestablish natural wildfire processes;
- introduction and spread of invasive species;
- modification of natural processes and changes in ecological potentials; and
- species extinction and/or reduction in population(s) and/or habitat(s).

Additionally, climate influences a variety of ecological processes. However, the true consequences of the risks posed by the threats are unknown because of the unidentified aspects about the complex interactions between the spatial and temporal variability of climate, ecosystem processes, disturbance regimes, hydrology, and forest management activities.

Aspen

Quaking aspen (aspen) occurs as a species primarily within the conifer forested PNVTs (ponderosa pine, wet mixed conifer, dry mixed conifer, and spruce-fir) and is found primarily on the Alpine, Black Mesa, and Springerville Ranger Districts (figure 27). As a species, aspen is adapted to a much broader range of environmental conditions than most plant species associated with it.

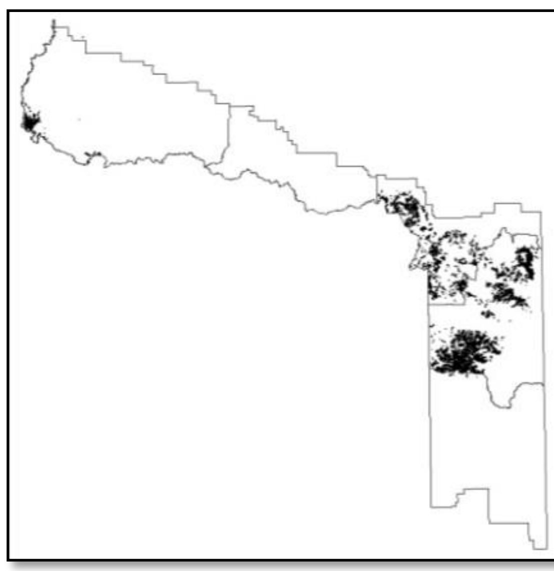

Figure 27. Location map of aspen across the Apache-Sitgreaves NFs

On the forests, this highly variable ecological community is composed mostly of aspen (roughly 24,000 acres) or aspen codominating with few to several conifer species (roughly 52,000 acres). The greatest number of aspen acres (50,335) is found in the wet mixed conifer PNVT. However, proportionally, the spruce-fir PNVT contains the largest aspen component at 33 percent (5,875 acres) and the ponderosa pine PNVT contains the smallest at 1 percent (5,988 acres).

Aspen exist as single-storied or multistoried depending on disturbance history and local stand dynamics. Due to their high productivity and structural diversity, aspen communities are capable of supporting the broadest array of plant and animal species of any forest type in the West and are considered second only to riparian areas in support of biological diversity (Mueggler, 1985; Kay, 1997; Chong et al., 2001). The understory structure may be complex with multiple shrub and herbaceous layers or simple with just an herbaceous layer.

According to Little (1976), aspens are very shade intolerant, form clonal thickets of relatively short-lived trees which are subsequently replaced by conifers, and grow in burned areas (pioneer trees). According to Bartos and Mueggler (1981), aspen reaches maturity in 80 to 120 years, with a few individual trees living 300 years or more (Jones and Schier, 1985). Relatively pure aspen stands may function as natural firebreaks across the landscape, support watershed stability, and contribute to scenic landscapes.

Aspen is considered a shade-intolerant, disturbance-dependent species, in that it is perpetuated on sites where fire, windthrow, fungal diseases, tent caterpillars and other insects, snow damage, hail, lightning, and sunscald (Jones and DeByle, 1985a and 1985b; Jones et al., 1985; Romme et al., 2009; Veblen, 2000), or other stand-replacing events are active (Bartos, 2001). Fire has long been recognized as a vital natural force in the perpetuation of aspen groves and forests in the Rocky Mountains (Baker, 1925). According to Romme et al. (2001), the most important agent of disturbance in aspen forests of the southern Rocky Mountains before 1900 was fire, although other natural disturbances were locally important. Without periodic fire or with high levels of herbivory, conifers will replace aspen. As a result, this type is significantly altered today and is very difficult to identify because of conifer succession. The presence of even a single aspen tree in a conifer stand provides strong evidence that the area historically supported aspen. Because of its communal root system, aspen is mechanically stable and a highly resilient species (Lieffers et al., 2001), and its presence may increase resistance of neighboring conifers to windthrow (Simard et al., 2001). As a direct result of the 2011 Wallow Fire, roughly 33 percent of the aspen overstory was eliminated and those acres are now being regenerated into the seedling/sapling size class with closed canopy characteristics, largely through clonal root sprouting (additional acres, previously unoccupied may be established through seed production and germination to new seedlings).

The decline in aspen throughout its western range is an ecological concern. This declining trend has been noted for the past 50 years, but aspen mortality has become more pronounced since about 2002. Not only are trees dying, but their clonal root systems are dying as well. Several factors have been hypothesized as causal agents in the decline of aspen: climate change, fire suppression, conifer competition, ungulate browsing, drought, insects, and pathogens (UFRWG, 2010; Crawford, 2011). As a consequence of the Wallow Fire, the acreage dominated by aspen is expected to increase on the Apache-Sitgreaves NFs. However, given all of the agents of decline mentioned, the longevity of this increase in aspen is unknown.

Large/Old Trees, Snags, and Coarse Woody Debris

In brief, large trees/old trees contribute to old growth forest conditions. According to Binkley et al. (2007), ecological processes are the driving forces behind any ecosystem, those processes are reflected and supported by the composition of the ecosystem, that is by the living and nonliving entities that exist in the ecosystem. Old growth forests, by definition, have old/large trees, but the presence of old trees is just the beginning of a description of the composition of an old growth forest (Binkley et al., 2007). Old growth forests are a significant and unique part of the diverse ecological web formed by natural forest landscapes. Human activities or natural disturbances in one part of the forest landscape can affect many other parts of the landscape (Silva Ecosystem Consultants, 1992). As an important part of the landscape ecology of natural forests, old growth provides unique resources for plants and animals (including people) within the landscape (Harris, 1984; Franklin et al., 1986). Old growth forests are also important because we do not fully understand their functions, the life forms they support, or their importance to the ecology of the Apache-Sitgreaves NFs.

Ecologically, a dead tree is as important to the forest ecosystem as a live one (Franklin et al., 1989) and, according to Marcot (2002), provides several key ecological functions that influence the ecosystem through trophic relations, species interactions, soil aeration, primary cavity and burrow excavation, and dispersal of fungi, lichens, seeds, fruits, plants, and invertebrates. Snags (standing dead trees) and rotting logs are essential to healthy forest ecosystems in several ways. Snags provide cavity and nesting sites for birds and roosting sites for bats, both of which eat insects. When snags fall and become coarse woody debris, they provide habitat for small animals and insects. When these logs rot they store water and provide nutrients for the continued growth of the forest. Dead wood rotting on the forest floor is eventually incorporated into the soil. This underground wood feeds many insects and bacteria which provide nitrogen to feed the trees and other plants in the forest. Underground wood is the major source of nitrogen for dry forests.

The importance of coarse woody debris in forests has been partially documented, although much remains to be discovered (Stevens, 1997). What is known is divided into four, inter-related categories: (1) the role in productivity of forest trees; (2) the role in providing habitat and structure to maintain biological diversity; (3) the role in geomorphology of streams and slopes; and (4) the role in long-term carbon storage. The importance of each to an ecosystem varies throughout the forests by natural disturbance type, biogeoclimatic zone, and moisture regime (Stevens, 1997).

Overstory and Herbaceous Understory Relationship

Since the arrival of Euro-Americans, herbaceous understory vegetation has been reduced by increased densities of established forest and woodland stands and encroachment of new forest and woodland stands into grasslands (Clary, 1971; Allen, 1998). Herbaceous vegetation cover and production within all PNVTs on the Apache-Sitgreaves NFs is departed from potential; anywhere from 1 to 87 percent and 8 to 91 percent for herbaceous cover and production, respectively. Overall, the least departure from potential in herbaceous cover and production has occurred in the spruce-fir forest, while the greatest departure from potential in herbaceous cover and production has occurred in the montane willow riparian forest.[24]

Historically, ponderosa pine and dry mixed conifer forests and Madrean pine-oak and piñon-juniper woodlands were generally characterized by open, 10 to 30 percent, canopies, Great Basin, semi-desert, and montane/subalpine grasslands were generally characterized by landscapes covered by grasses and forbs with less than 10 percent woody canopy cover.

Today, over 60 percent of the ponderosa pine and dry mixed conifer forests, 75 percent of the Madrean pine-oak woodland, and 20 percent of the piñon-juniper woodland have canopy cover

[24] Data gleaned from Laing et al., 1987.

greater than 30 percent. Approximately 85 percent of the Great Basin and 79 percent of the semi-desert grasslands have woody canopy cover greater than 10 percent.

Herbaceous understory vegetation and grassland vegetation provide habitat, hiding, and thermal cover, nesting sites, and food sources for a myriad of plant and animal species. In addition, understory vegetation provides the fine fuels that maintain and support the natural fire regimes (relatively frequent, low-intensity fires) needed to renew these forested, woodland, and grassland PNVTs, as well as the organic matter needed for soil development.

Fire is one of the most influential forces in inhibiting woody species encroachment (Daubenmire, 1968; Allen, 1984) into grasslands. The alteration of natural fire regimes by suppression, introduction of livestock, shifts in climate, atmospheric CO_2 enrichment, and reduced soil moisture have disrupted these ecosystems in many ways, including the extensive loss of herbaceous vegetation. These actions have contributed to an increase in the distribution and density of woody overstory vegetation.

Jameson (1967) found a greater than 2.3- to 3.4-fold increase in herbaceous understory vegetation production between open (30 percent or less) and closed (greater than 30 percent) canopy sites in ponderosa pine forests in northern Arizona. Tree canopy closure in southwestern ponderosa pine old growth stands ranges from 17 to 30 percent (Laughlin et al., 2006), which suggests that understory patches may have composed greater than 70 percent of the forested landscape.

Moore and Deiter (1992) reported that understory vegetation response to overstory reduction appeared to be dependent on understory plant type. They found that overstory density effects on understory production were most predictable for herbaceous plants (i.e., grasses, sedges, forbs) while shrubs showed only a slight response to changing overstory density. The extent that understory vegetation responds to overstory removal also depends on the health and condition of the existing understory community and its ability to respond as well as available seed bank and soil productivity.

The desired conditions for understory vegetation within the forested, woodland, and riparian PNVTs have the composition, structure, and function of the herbaceous and shrub (where appropriate) layers to provide for species of all ages and size classes within these communities and promote a greater level of ecosystem health by moving them closer to desired conditions. The desired conditions for the grassland communities have the composition, structure, and function to promote a greater level of ecosystem health (moving closer to desired conditions) provided by grassland species of all ages and size classes, namely by removing woody vegetation and invasive species.

Environmental Consequences of Alternatives

The underlying assumption is that for each PNVT the closer their ecological composition, structure, and processes are to their reference conditions (having low departure indices[25] (DI)

[25] Departure index (DI) measures the degree to which the state composition, structure, and cover between current and reference conditions are dissimilar and it is being used as an inference of sustainability; the lower the DI, the closer to reference conditions and the greater the sustainability. The five DI classes are described at the beginning of this section. The higher the DI class number, the more altered the ecosystem is from reference conditions. The DI provides a quantitative value used for reference and comparison in discussions regarding the PNVTs. The current DI can also be compared to results derived from modeling potential change.

versus a high DI), the more properly each PNVT is functioning and the more secure dependent species (plants and animals) are within the associated habitats. This is particularly important with potential changes in the climate. The intent is to reestablish the natural patterns and processes within these vegetation communities that allowed for natural resiliency; especially important when faced with uncharacteristic wildfire, the presence of invasive plant species, and climate change. More detailed descriptions of the environmental consequences, including expected changes to individual vegetation structural states, can be found in the "Vegetation Specialist Report" (Forest Service, 2014t).

PNVTs Modeled with VDDT

Ponderosa Pine Forest PNVT

Based on the treatment objectives for each alternative (table 25), the departure index (DI) is expected to vary by alternative (table 26).

After one planning period, the proposed high treatment objective under **alternative C** would produce the greatest movement toward desired conditions, from the current rating of 77 to 52 (table 26). This is a change of one DI class, from high to moderate. Under this alternative there would be the greatest overall reduction of all size and age trees, single-storied or multistoried with closed canopy cover; it would have the greatest overall increase of medium to very large size, single-storied or multistoried trees with open canopy cover. Reductions in overstory canopy cover favor shade intolerant and very shade intolerant species, including the herbaceous vegetation understory.

Table 25. Annual treatment objective levels (acres) by alternative in the ponderosa pine PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
A	—	—	—	—	7,119	3,150
B	11,025	11,025	1,552	1,575	6,289	6,300
C	24,255	10,187	2,426	1,040	13,341	5,614
D	9,450	22,050	1,417	3,308	5,434	12,679

Table 26. Fifteen-year (planning period) ponderosa pine PNVT departure index (DI) by alternative treatment objective levels; current DI is H^{77}

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	—	H^{63}	M^{52}	H^{61}
Average	H^{65}	H^{63}	M^{60}	H^{66}
Low	—	H^{69}	H^{69}	H^{70}

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure

The proposed average treatment objectives under **alternative C** would produce the second greatest movement toward desired conditions, from the current rating of 77 to 60. This is also a change of one DI class, from high to moderate. The proposed high treatment objectives under **alternative D** would produce the third greatest movement toward desired conditions, from the current rating of 77 to 61. However, this would not change its high departure rating. The high and average treatment objectives under **alternative B** would produce the fourth greatest movement toward desired conditions. The low treatment objectives proposed under the **action alternatives** and the average treatment objectives proposed under **alternative D** would provide less movement toward desired conditions than **alternative A**.

Figure 28 displays the long-term trend toward desired conditions for ponderosa pine based on the proposed average acre treatments. **All alternatives** produce reductions in departure from immediately and continue to move toward desired conditions through all modeling periods (out to 50 years). **All alternatives** move from a high to moderate departure class. Overall, **alternatives A, B and C** produce the greatest movement toward desired conditions, respectively; followed by **alternative D**.

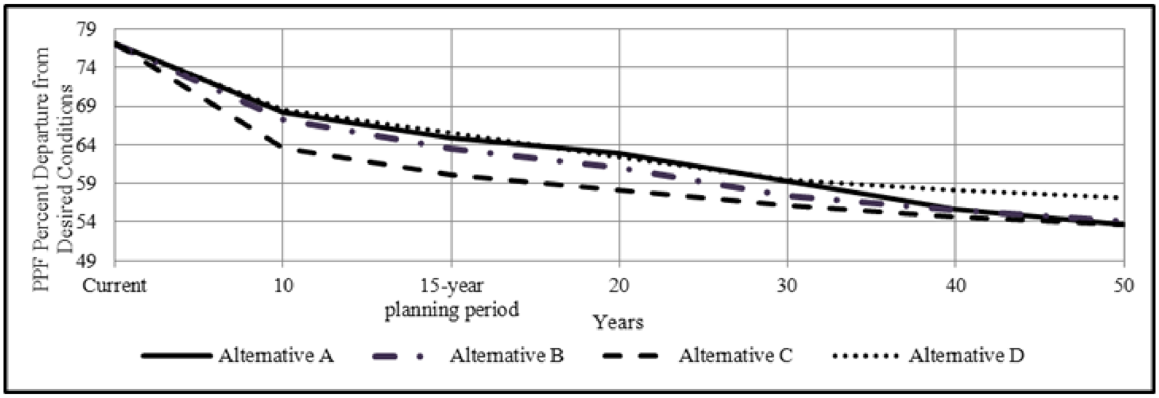

Figure 28. Ponderosa pine PNVT departure index from desired condition trend, over a 50-year time period, for the average treatment level

In summary, for the proposed average acre treatment objectives, **alternative C** does the most to address the threats and risks within the 15-year planning period, followed by **alternative B**, then **A**, and finally **D** when assessing movement toward both. When assessing movement toward desired conditions over the 50-year modeling period for the proposed average acre treatment objectives, **alternatives A, B, and C** equally address the threats and risks more than **alternative D.**

Large/Old Trees, Snags, and Coarse Woody Debris

After one planning period, **none of the alternatives** would achieve the desired conditions for number of acres of vegetation states composed of large/old trees (table 27). However, the proposed high treatment objectives under **alternative D** would provide the greatest movement toward desired conditions. This is followed by **alternative A**, **alternative D** proposed low treatment objectives, **alternative C** proposed low treatment objectives, **alternative B** proposed high and low treatment objectives, and finally **alternative C** proposed high treatment objectives.

Table 27. Acres of large/old trees, number of snags greater than 18 inch diameter (DBH) per acre, and tons of the three size classes of coarse woody debris per acre at the end of the 15-year planning period within the ponderosa pine PNVT

Alternative	Vegetation Structural	Across All	Ponderosa Pine	Vegetation	Structural	States
	States E, I, K, M[a]	Number of Snags	Tons of	Coarse	Woody	Debris
	Acres of Large/Old Trees	≥ 18″ DBH/acre	≤ 3″ (diameter/acre)	> 3″ & ≤ 12″(diameter/acre)	> 12″ (diameter/acre	Total (diameter/acre)
Desired Condition	427,566	average 1–2	range from 3–10	range from 3–10	range from 3–10	range from 3–10
Current	175,013	3.1	4.4	6.5	2.9	13.8
A	219,145	3.7	4.6	7.1	3.5	15.2
B High	202,935	3.5	4.5	6.9	3.4	14.8
B Average	206,655	3.6	4.4	6.7	3.4	14.5
B Low	201,048	3.5	4.6	7.0	3.3	14.9
C High	199,004	3.6	4.5	6.7	3.4	14.6
C Average	200,026	3.5	4.0	6.3	3.3	13.6
C Low	204,795	3.5	4.7	7.0	3.4	15.1
D High	270,289	4.1	4.7	7.4	3.6	15.7
D Average	241,884	3.8	4.7	7.5	3.8	16.0
D Low	213,478	3.6	4.7	7.2	3.4	15.3

[a] See appendix B in the proposed plan for a description of vegetation structural states.

Wet Mixed Conifer Forest PNVT

Based on the planned treatment objectives for each alternative (table 28), the departure index (DI) is expected to vary by alternative (table 29).

Table 28. Annual treatment objective levels (acres) by alternative in the wet mixed conifer PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
A	—	—	—	—	2,147	950
B	3,325	3,325	475	475	1,900	1,900
C	7,315	3,135	731	313	4,023	1,725
D	2,851	6,650	428	998	1,640	3,824

Table 29. Fifteen-year (planning period) wet mixed conifer PNVT departure index (DI) by alternative treatment objective levels; current DI is M^{54}

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	—	M^{52}	M^{56}	M^{50}
Average	M^{49}	M^{53}	M^{56}	M^{52}
Low	—	M^{54}	M^{55}	M^{54}

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure

After one planning period, the average treatment objectives under **alternative A** would produce the greatest movement toward desired conditions, from the current rating of 54 to 49 (table 29). However, this does not produce a change in the DI class; it would remain moderate. Under **alternative A** there would be the greatest overall reduction in vegetation structural states lacking aspen regeneration and the greatest overall increase of medium to very large size, single-storied or multistoried trees with open canopy cover. Reduction in overstory canopy cover would favor aspen and mixed shade tolerant species, including the herbaceous vegetation understory.

The proposed high treatment objectives under **alternative D** produce the second greatest movement toward desired conditions, from the current rating of 54 to 50. However, this does not produce a change in the DI class; it would remain moderate. The proposed high treatment objectives under **alternative B** and the average treatment objectives under **alternative D** would produce the third greatest movement toward desired conditions, from the current rating of 54 to 52. Again, this would not produce a change in the DI classes; they would remain moderate. The proposed **alternative B** low and average treatment objectives, all aspects of **alternative C**, and the proposed low treatment objectives in **alternative D** would produce less change or no change in the movement toward desired conditions compared to **alternative A**.

Figure 29 displays the long-term trend in relation to desired conditions for wet mixed conifer, based on the average treatment acres. **Alternative A** would produce the greatest movement toward desired conditions during the planning period and would continue throughout all modeling periods. **Alternatives B and D** would produce some movement toward desired conditions, while **alternative C** would continue to trend away throughout all modeling periods. However, around year 30, trend changes very little in **all alternatives** and management changes would be needed to reset movement toward desired conditions within this PNVT.

In summary, for the proposed average acre treatment objectives, when assessing movement toward desired conditions, **alternative A** does the most to address the threats and risks within the 15-year planning period followed by **alternative D**, then **B,** and finally **C**. For the proposed average acre treatment objectives, when assessing movement toward desired conditions, within the 50-year modeling period, **alternative A** does the most to address the threats and risks followed by **alternative D**, then **B**, and finally **C**.

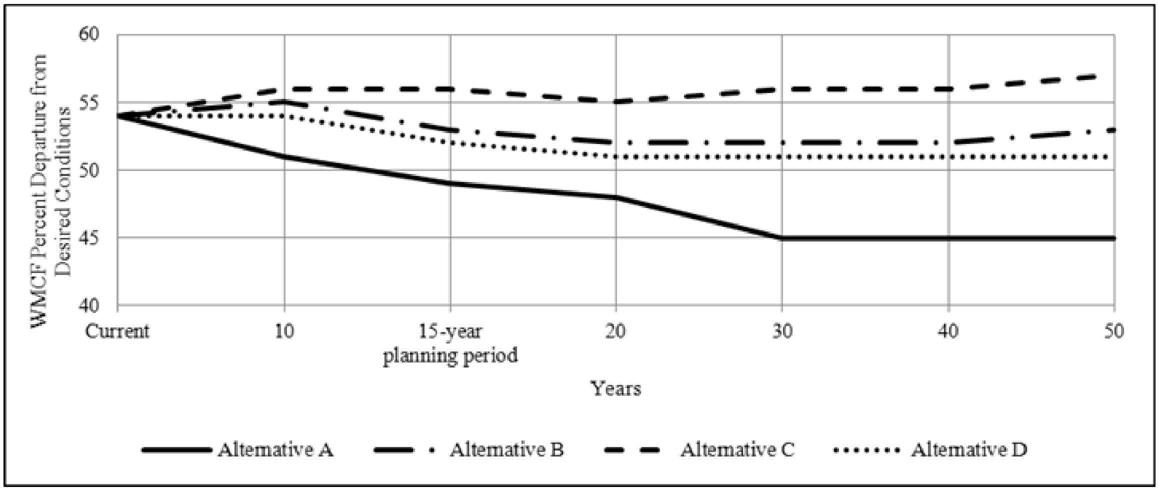

Figure 29. Wet mixed conifer PNVT departure index from desired condition trend, over a 50-year period, for the average treatment level

Large Trees/Old Trees, Snags, and Coarse Woody Debris

After one planning period, **none of the alternatives** would achieve the desired conditions for number of acres of vegetation states composed of large/old trees (table 30). However, the proposed high treatment objectives under **alternative D** would provide the greatest movement toward desired conditions. This is followed by **alternative C** proposed high treatment objectives, **alternative B** proposed high treatment objectives, **alternative A**, **alternative C** proposed low treatment objectives, **alternative D** proposed low treatment objectives, and finally **alternative B** proposed low treatment objectives.

Table 30. Acres of large/old trees, number of snags greater than 18 inch diameter (DBH) per acre, and tons of the three size classes of coarse woody debris per acre at the end of the 15-year planning period within the wet mixed conifer PNVT

Alternative	Vegetation Structural	Across All	Wet Mixed	Conifer	Vegetation	Structural States
	States E, F, I, J, N, O, R, Sa	Number of Snags	Tons of	Coarse	Woody	Debris
	Acres of Large/Old Trees	≥ 18″ DBH/acre	≤ 3″ (diameter/acre)	> 3″ & ≤ 12″ (diameter/acre)	> 12″ (diameter/acre)	Total (diameter/acre)
Desired Condition	80,543	1–5	range from 5–40	range from 5–40	range from 5–40	range from 5–40
Current	20,058	9.8	8.2	16.6	10.5	35.3
A	36,004	10.0	9.5	18.6	12.7	40.7
B High	39,080	10.4	9.6	18.5	12.7	40.8
B Average	36,238	10.0	9.5	18.4	12.6	40.5
B Low	33,396	9.7	9.4	18.3	12.5	40.2
C High	39,966	10.7	9.2	17.7	12.3	39.3
C Average	36,729	10.2	9.3	18.0	12.3	39.2

Alternative	Vegetation States E, F, I, J, N, O, R, Sa Acres of Large/Old Trees	Number of Snags ≥ 18″ DBH/acre	Tons of Coarse Woody Debris			
			≤ 3″ (diameter/acre)	> 3″ & ≤ 12″ (diameter/acre)	> 12″ (diameter/acre)	Total (diameter/acre)
C Low	33,492	9.7	9.4	18.2	12.5	40.1
D High	41,950	11.0	9.7	19.2	13.3	42.2
D Average	37,689	10.4	9.6	18.7	12.9	41.2
D Low	33,428	9.8	9.4	18.3	12.6	40.3

[a] See appendix B in the proposed plan for a description of vegetation structural states.

Dry Mixed Conifer Forest PNVT

Based on the treatment objectives for each alternative (table 31), the departure index (DI) is expected to vary by alternative (table 32).

Table 31. Annual treatment objective levels (acres) by alternative in the dry mixed conifer PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
	—	—	—	—	1,808	800
B	2,772	2,910	396	416	1,584	1,663
C	6,160	2,772	616	277	3,388	1,525
D	2,400	5,880	360	881	1,380	3,381

Table 32. Fifteen-year (planning period) dry mixed conifer PNVT departure index (DI) by alternative treatment objective levels; current DI is H^{67}

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	—	M^{53}	M^{49}	M^{56}
Average	M^{57}	M^{56}	M^{54}	M^{58}
Low	—	M^{60}	M^{59}	M^{59}

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure

After one planning period, the proposed high treatment objectives under **alternative C** would produce the greatest movement toward desired conditions, from the current rating of 67 to 49 (table 32). This would be a change of one DI class, from high to moderate.

The proposed high treatment objectives under **alternative B** would produce the second greatest movement toward desired conditions, from the current rating of 67 to 53. This is a change of one DI class, from high to moderate. The proposed average treatment objectives under **alternative C** would produce the third greatest movement toward desired conditions, from the current rating of 67 to 54. This is also a change of one DI class, from high to moderate. The low treatment objectives proposed under the **action alternatives** and the average treatment objectives proposed under **alternative D** would provide less movement toward desired conditions than **alternative A.**

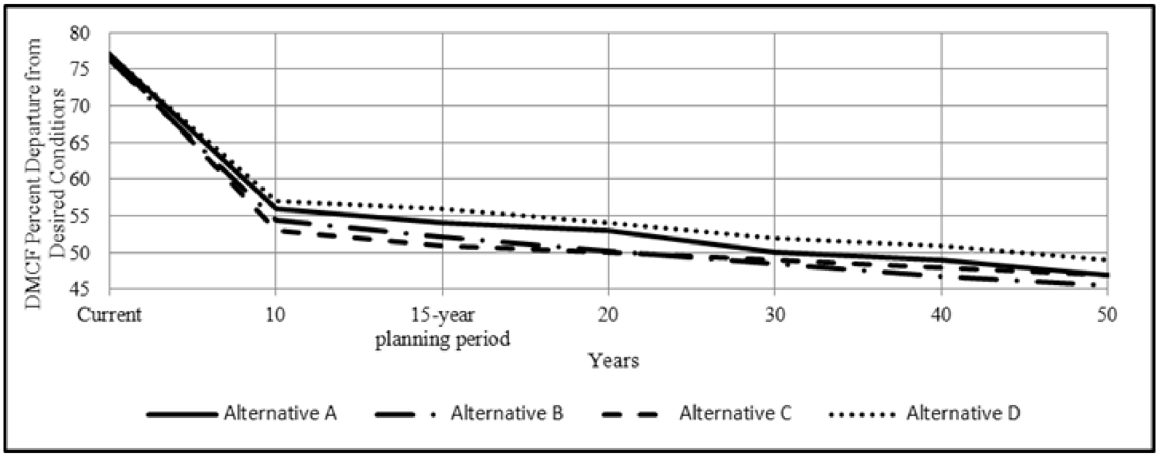

Figure 30. Dry mixed conifer PNVT departure index from desired condition trend, over a 50-year time period, for the average treatment level

As **all alternatives** move toward desired conditions, there would be an overall reduction of all size and age trees, single-storied or multistoried with closed canopy cover. There would be an increase of medium to very large size, single-storied or multistoried trees with open canopy. Reduction in overstory canopy cover would favor shade intolerant and very shade intolerant species, including the herbaceous vegetation understory.

Figure 30 displays the long-term trend toward desired conditions for dry mixed conifer based on the average treatment acres. **All alternatives** would produce movement toward desired conditions immediately and would continue to trend toward desired conditions through all modeling periods. They would all move from high to moderate departure. Overall, **alternative A** would produce the greatest movement toward desired conditions over the **other alternatives**.

In summary, for the proposed average acre treatment objectives, when assessing movement toward desired conditions, **alternative C** does the most to address the threats and risks within the 15-year planning period followed by **alternative B**, then **A**, and finally **D**. When assessing movement toward desired conditions over the 50-year modeling period for the proposed average acre treatment objectives, **alternative A** does the most to address the threats and risks followed by **alternative B**, then **C**, and finally **D**.

Large Trees/Old Trees, Snags, and Coarse Woody Debris

After one planning period, **none of the alternatives** would achieve the desired conditions for number of acres of vegetation states composed of large/old trees (table 33). However, the proposed high treatment objectives under **alternative D** would provide the greatest movement toward desired conditions. This is followed by **alternative C** proposed high treatment objectives,

alternative B proposed high treatment objectives, **alternative A**, **alternative B** proposed low treatment objectives, **alternative C** proposed low treatment objectives, and finally **alternative D** proposed low treatment objectives.

Table 33. Acres of large/old trees, number of snags greater than 18 inch diameter (DBH) per acre, and tons of the three size classes of coarse woody debris per acre at the end of the 15-year planning period within the dry mixed conifer PNVT

Alternative	Vegetation Structural States E, I, K, Ma Acres of Large/Old Trees	Across All Number of Snags ≥ 18″ DBH/acre	Dry Mixed Tons of ≤ 3″ (diameter/acre)	Conifer Coarse > 3″ & ≤ 12″ (diameter/acre)	Vegetation Woody > 12″ (diameter/acre)	Structural States Debris Total (diameter/acre)
Desired Condition	84,295	average 3	range from 5–15	range from 5–15	range from 5–15	range from 5–15
Current	17,618	4.9	10.1	10.5	5.4	26.0
A	30,071	7.9	7.3	11.5	6.3	25.2
B High	34,905	8.3	7.0	10.9	6.0	23.9
B Average	32,618	8.1	7.3	11.3	6.3	24.9
B Low	29,606	7.9	7.5	11.8	6.6	25.9
C High	36,116	8.4	6.8	10.4	5.7	22.9
C Average	31,648	8.0	7.2	11.2	6.2	24.6
C Low	27,179	7.5	7.6	12.0	6.7	26.3
D High	36,995	8.2	7.2	11.6	6.6	25.4
D Average	31,598	7.7	7.4	11.8	6.6	25.9
D Low	26,201	7.3	7.6	12.0	6.7	26.3

[a] See appendix B in the proposed plan for a description of vegetation structural states.

Spruce-Fir Forest PNVT

Based on the planned treatment objectives for each alternative (table 34), the departure index (DI) is expected to vary by alternative (table 35).

Table 34. Annual treatment objective levels (acres) by alternative in the spruce-fir PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
A	—	—	—	—	108	100
B	95	606	14	87	55	347
C	208	892	16	93	112	493
D	36	964	6	145	21	555

Table 35. Fifteen-year (planning period) spruce-fir PNVT departure index (DI) by alternative treatment objective levels; current DI is M[59]

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	-	H [64]	H[63]	H[64]
Average	H[68]	H[66]	H [65]	H [65]
Low	-	H [68]	H[67]	H [67]

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure.

After one planning period, **all alternatives** would trend away from desired conditions and change one DI class, from moderate to high (table 35). Within the planning period, no alternative would produce a reduction of vegetation structural states that are lacking aspen regeneration or an increase of medium to very large size, single-storied or multistoried trees with open canopy. In addition, there would be no reduction in overstory canopy cover to favor aspen and mixed shade tolerant species, including the herbaceous vegetation understory.

However, the proposed high treatment objectives under **alternative C** would produce the smallest increase in departure, from the current rating of 59 to 63. The proposed high treatment objectives under **alternatives B and D** would produce the next smallest increase, from the current rating of 59 to 64. The average treatment objectives under **alternative A** and the proposed low treatment objectives in **alternative B** would produce the greatest departure, from the current rating of 59 to 68. As mentioned earlier, these are all changes of one departure class, from moderate to high.

Figure 31 displays the long-term trend in relation to desired conditions for spruce-fir based on the average treatment acres. At first, **all alternatives** would increase in departure from desired conditions immediately; however at year 10, the trend reverses and **all alternatives** would begin trending toward desired conditions throughout all modeling periods. At the end of the modeling period (50 years), **alternative D** would produce the greatest movement toward desired conditions. By the end of the modeling period, **all alternatives** would have moved from a moderate to a high departure rating. However, it appears that around year 10 management changes would be needed to reset movement toward desired conditions within this PNVT.

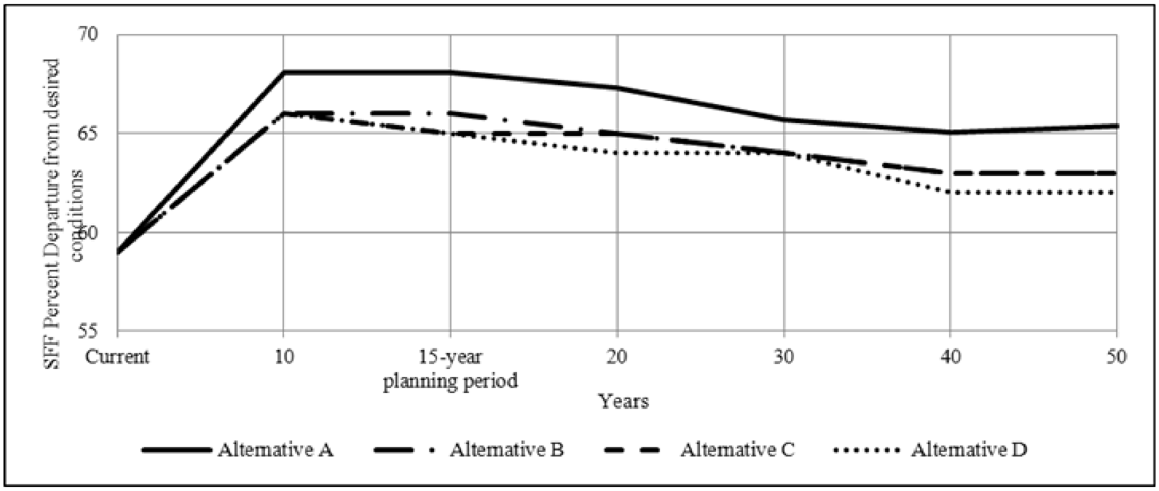

Figure 31. Spruce-fir PNVT departure index from desired condition trend, over a 50-year time period, for the average treatment level

In summary, for the proposed average acre treatment objectives, when assessing movement toward desired conditions, **alternatives C and D** equally do more to address the threats and risks within the 15-year planning period followed by **alternative B**, then finally **A**. When assessing movement toward desired conditions over the 50-year modeling period for the proposed average acre treatment objectives**, alternative D** does more to address the threats and risks followed equally by **alternatives B and C**, then finally **A**.

Large/Old Trees, Snags, and Coarse Woody Debris

After one planning period, **none of the alternatives** would achieve the desired conditions for number of acres of vegetation states composed of large/old trees (table 36). However, the proposed high treatment objectives under **alternative D** would provide the greatest movement toward desired conditions. This is followed by **alternative C** proposed high treatment objectives, **alternative B** proposed high treatment objectives, **alternative A**, **alternative B** proposed low treatment objectives, **alternative D** proposed low treatment objectives, and finally **alternative C** proposed low treatment objectives.

Table 36. Acres of large/old trees, number of snags greater than 18 inch diameter (DBH) per acre, and tons of the three size classes of coarse woody debris per acre at the end of the 15-year planning period within the spruce-fir PNVT

Alternative	Vegetation Structural	Across All Spruce-Fir Vegetation Structural States				
	States E, F, I, J, N, O, R, S[a]	Number of Snags	Tons of Coarse Woody Debris			
	Acres of Large/Old Trees	≥ 18″ DBH/acre	≤ 3″ (diameter/acre)	> 3″ & ≤ 12″ (diameter/acre)	> 12″ (diameter/ acre)	Total (diameter/ acre)
Desired Condition	7,067	1–3	range from 5–40	range from 5–40	range from 5–40	range from 5–40
Current	1,829	8.4	10.1	20.7	7.4	38.2
A	3,660	13.1	12.8	25.4	11.4	49.7
B High	4,344	14.6	13.2	26.5	12.4	52.1
B Average	3,970	13.8	13.0	25.9	11.9	50.7
B Low	3,596	12.9	12.8	25.3	11.3	49.5
C High	4,525	15.1	13.2	26.7	12.8	52.6
C Average	4,029	14.1	13.0	26.0	12.0	51.0
C Low	3,533	13.0	12.7	25.3	11.3	49.4
D High	4,587	15.2	13.3	26.9	12.8	53.0
D Average	4,090	14.1	13.0	26.1	12.1	51.2
D Low	3,593	13.1	12.7	25.4	11.4	49.5

[a] See appendix B in the proposed plan for a description of vegetation structural states.

Madrean Pine-Oak Woodland PNVT

Based on the planned treatment objectives for each alternative (table 37), the departure index (DI) is expected to vary by alternative (table 38).

Table 37. Annual treatment objective levels (acres) by alternative in the Madrean pine-oak PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
A	—	—	—	—	0	1,063
B	0	11,143	0	3,714	0	7,429
C	0	5,000	0	1,250	0	3,125
D	0	22,335	0	3,722	0	13,029

Table 38. Fifteen-year (planning period) Madrean pine-oak PNVT departure index (DI) by alternative treatment objective levels; current DI is H[61]

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	-	M[41]	M[50]	L[28]
Average	M[59]	M[47]	M[55]	M[41]
Low		M[54]	M[59]	M[54]

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure

After one planning period, the proposed high treatment objectives under **alternative D** would produce the greatest movement toward desired conditions, from the current rating of 61 to 28 (table 38). This would be a change of two DI classes, from high to low.

The proposed high treatment objectives under **alternative B** and the average treatment objectives under **alternative D** would produce the second greatest movement toward desired conditions, from their current ratings of 61 to 41. This would be a change of one DI classes, from high to moderate. The average treatment objectives under **alternative A** and the proposed low treatment objectives under **alternative C** would produce the least movement toward desired conditions, from the current rating of 61 to 59. However, this would change their DI class, from high to moderate.

As **all alternatives** move toward desired conditions, there would be an overall increase of seedlings, saplings, small, and medium to very large size, single-storied or multistoried trees with open canopy cover. There would also be a reduction in closed canopy structural states. Reduction in overstory canopy cover would favor shade intolerant and very shade intolerant species, including the herbaceous vegetation understory.

Figure 32 displays the long-term trend in relation to desired conditions for Madrean pine-oak based on the average treatment acres. All **action alternatives** would produce reductions in departure from desired conditions immediately; however, **alternative D** has the greatest movement during the planning period and across the modeling period (at which point departure has dropped two classes). **Alternatives B, C, and A**, respectively, lag behind. However, **alternative B** would also decrease two departure classes, while **alternatives A and C** would each decrease by one departure class.

In summary, for the proposed average acre treatment objectives, **alternative D** does the most to address the threats and risks within both the 15-year planning and the 50-year modeling periods followed by **alternative B**, then **C**, and finally **alternative A** when assessing movement toward desired conditions.

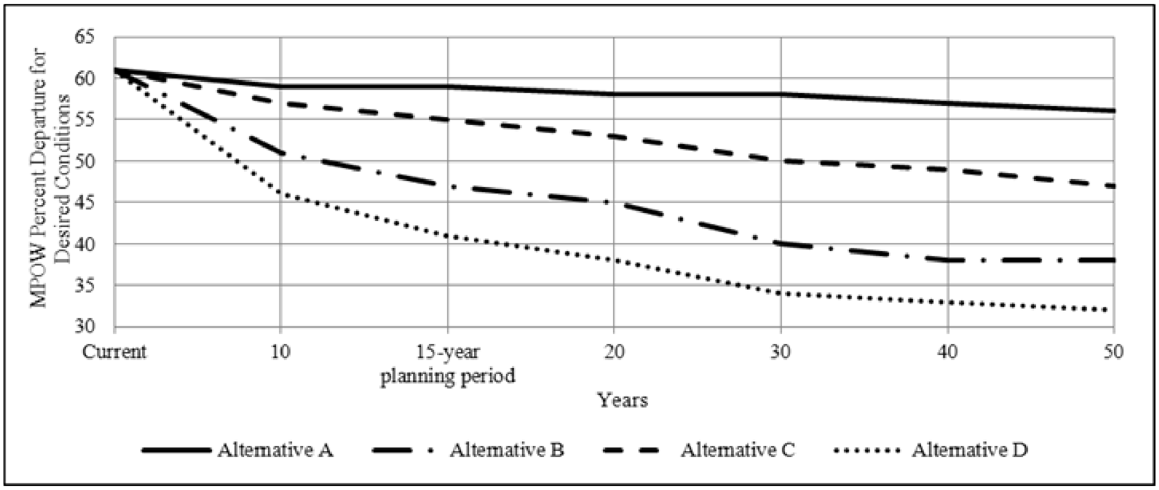

Figure 32. Madrean pine-oak PNVT departure index from desired condition trend, over a 50-year time period, for the average treatment level

Large/Old Trees, Snags, and Coarse Woody Debris

After one planning period, **none of the alternatives** would achieve the desired conditions for number of acres of vegetation states composed of large/old trees (table 39). However, the proposed high treatment objectives under **alternative D** would provide the greatest movement toward desired conditions. This is followed by **alternative D** proposed low treatment objectives, **alternative B** proposed high treatment objectives, **alternative B** proposed low treatment objectives, **alternative C** proposed low treatment objectives, **alternative A**, and finally **alternative C** proposed high treatment objectives

Table 39. Acres of large/old trees, number of snags greater than 18 inch diameter (DBH) per acre, and tons of the three size classes of coarse woody debris per acre at the end of the 15-year planning period within the Madrean pine-oak PNVT

Alternative	Vegetation Structural States D, G[a]	Across All	Madrean	Pine-Oak	Vegetation	Structural States
		Number of Snags	Tons of	Coarse	Woody	Debris
	Acres of Large/Old Trees	≥ 18″ DBH/acre	≤ 3″ (diameter/ acre)	> 3″ & ≤ 12″ (diameter/ acre)	> 12″ (diameter/ acre)	Total (diameter/ acre)
Desired Condition	84,295	average 3	1–3	1–3	1–3	1–3
Current	119,259	0.9	0.3	1.3	0.8	2.4
A	167,913	1.4	3.4	3.6	2.1	9.0
B High	176,473	1.3	2.8	3.0	1.8	7.6
B Average	176,088	1.4	3.1	3.2	1.9	8.2
B Low	175,703	1.4	3.3	3.5	2.1	8.9
C High	162,582	1.3	3.0	3.1	1.9	8.0
C Average	171,142	1.3	3.2	3.4	2.0	8.6
C Low	174,370	1.4	3.4	3.6	2.1	9.2
D High	178,991	1.3	2.4	2.5	1.5	6.4
D Average	178,695	1.3	2.8	3.0	1.8	7.6
D Low	178,399	1.4	3.3	3.5	2.1	8.8

[a] See appendix B in the proposed plan for a description of vegetation structural states.

Piñon-Juniper Woodland PNVT

Based on the planned treatment objectives for each alternative (table 40), the departure index (DI) is expected to vary by alternative (table 41).

Table 40. Annual treatment objective levels (acres) by alternative in the piñon-juniper PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
A	—	—	—	—	500	713
B	2,341	1,412	780	470	1,561	941
C	4,213	600	1,053	150	2,633	375
D	4,042	3,443	673	575	2,358	2,009

Table 41. Fifteen-year (planning period) piñon-juniper PNVT departure index (DI) by alternative treatment objective levels; current DI is L[26]

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	—	N[19]	N[18]	N[19]
Average	L[21]	N[20]	N[19]	N[19]
Low	—	N[20]	L[21]	N[20]

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure

After one planning period, the proposed high treatment objectives under **alternative C** would produce the greatest movement toward desired conditions, from the current rating of 26 to 18 (table 41). There would be a change in DI class from low to no departure.

All proposed treatments under **alternatives B and D** and the proposed average treatment objectives under **alternative C** would produce movement toward desired conditions, from the current rating of 26 to 19 and 20. These are all changes in departure index class from low to no departure. The average acre treatments under **alternative A** and the proposed low acre treatments under **alternative C** would not change departure class.

As **all alternatives** move toward desired conditions, there would be an overall increase of seedling, saplings, small, and medium to very large size, single-storied or multistoried trees with open canopy cover and a reduction in closed canopy. Reduction in overstory canopy cover would favor shade intolerant and very shade intolerant species, including the herbaceous vegetation understory.

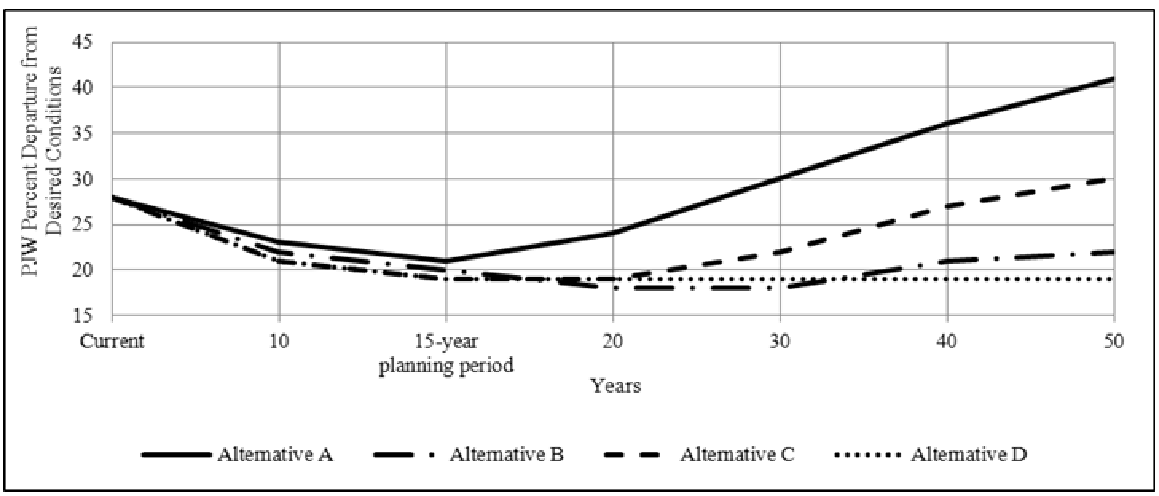

Figure 33. Piñon-juniper PNVT departure index from desired condition trend, over a 50-year time period, for the average treatment level

Figure 33 displays the long-term trend in relation to desired conditions for piñon-juniper based on the average treatment acres. **All alternatives** would produce reductions in departure from desired conditions immediately; however, around 15 to 20 years, **all alternatives** would start trending away from desired conditions.

Alternative D would maintain a lower departure trend than the other alternatives; while **alternative A** would maintain a higher departure trend than **alternatives B and C**. **Alternative D** would maintain the lowest departure rating across the modeling period, followed by **alternatives B, C,** and then **A**. Only **alternative D** would end in a no departure class, while **alternatives B and C** would end in a low DI class and **alternative A** would end in a moderate DI class. However, it appears that around year 15 trend changes in **all alternatives** and management changes would be needed to reset movement toward desired conditions within this PNVT.

In summary, for the proposed average acre treatment objectives, when assessing movement toward desired conditions **alternatives C** and **D** equally do more to address the threats and risks by the end of the 15-year planning period followed by **alternative B**, and finally **A**. However, when assessing movement toward desired conditions by the end of the 50-year modeling period for the proposed average acre treatment objectives, **alternative D** does more to address the threats and risks, followed by **alternative B**, then **C**, and finally **A**.

Large/Old Trees, Snags, and Coarse Woody Debris

After one planning period, **none of the alternatives** would achieve the desired conditions for number of acres of vegetation states composed of large/old trees (table 42). However, the proposed high treatment objectives under **alternative D** would provide the greatest movement toward desired conditions. This is followed by **alternative C** proposed high treatment objectives, **alternative B** proposed high treatment objectives, **alternative D** proposed low treatment objectives, **alternative A**, **alternative C** proposed low treatment objectives, and finally **alternative B** proposed low treatment objectives.

Table 42. Acres of large/old trees, number of snags greater than 18 inch diameter (DBH) per acre, and tons of the three size classes of coarse woody debris per acre at the end of the 15-year planning period within the piñon-juniper PNVT

Alternative	Vegetation Structural States D, G[a] Acres of Large/Old Trees	Across All Number of Snags ≥ 18″ DBH/acre	Piñon- Tons of ≤ 3″ (diameter/ acre)	Juniper Coarse > 3″ & ≤ 12″ (diameter/ acre)	Vegetation Woody > 12″ (diameter/ acre)	Structural States Debris Total (diameter/ acre)
Desired Condition	99,971	1–2	2–5	2–5	2–5	2–5
Current	139,845	1.5	0.6	2.2	1.4	4.2
A	128,541	1.4	0.7	2.9	1.4	5.0
B High	128,307	1.4	0.7	2.4	1.3	4.4
B Average	129,806	1.4	0.7	2.6	1.4	4.6
B Low	129,844	1.4	0.7	2.7	1.4	4.8
C High	125,196	1.4	0.7	2.5	1.3	4.5
C Average	128,408	1.4	0.7	2.8	1.4	5.0
C Low	129,768	1.4	0.7	2.8	1.4	4.9
D High	124,493	1.4	0.6	2.1	1.2	3.9
D Average	128,357	1.4	0.6	2.4	1.3	4.3
D Low	128,508	1.4	0.7	2.7	1.4	4.8

[a] See appendix B in the proposed plan for a description of vegetation structural states.

Great Basin Grassland PNVT

Based on the planned treatment objectives for each alternative (table 43), the departure index (DI) is expected to vary by alternative (table 44).

Table 43. Annual treatment objective levels (acres) by alternative in the Great Basin grassland PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
A	—	—	—	—	500	41
B	10,269	10,000	5,135	5,000	7,702	7,500
C	0	0	0	0	0	0
D	6,161	14,000	3,081	7,000	4,621	10,500

Table 44. Fifteen-year (planning period) Great Basin grassland PNVT departure index (DI) by alternative treatment objective levels; current DI is H^{66}

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	—	N^{9}	H^{63}	N^{8}
Average	H^{63}	N^{17}	H^{63}	N^{19}
Low	—	L^{24}	H^{63}	L^{29}

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure

After one planning period, the proposed high treatment objectives under **alternative D** would produce the greatest movement toward desired conditions, from the current rating of 67 to 8 (table 44). This would be a change of four DI classes, from high to no departure. The proposed high treatment objectives under **alternative B** would produce the second greatest movement toward desired conditions, from the current rating of 67 to 9. This would also be a change of four DI classes, from high to no departure. The proposed average treatment objectives under **alternative B** would produce the third greatest movement toward desired conditions, from the current rating of 67 to 17. This would be a change of three DI classes, from high to low. There would be no planned treatments under **alternative C**.

As **alternatives D and B** move toward desired conditions, there would be a reduction in woody vegetation encroachment and a return to historic grassland conditions (dense stands of perennial grasses and forbs with less than 10 percent woody canopy cover). Reduction in overstory canopy cover would favor shade intolerant and very shade intolerant herbaceous species.

Under **alternatives A and C**, Great Basin grassland would stay highly departed from desired conditions. This grassland would continue to be encroached by shrubs and trees of all sizes with open and closed canopies and lack adequate stands of perennial grasses and forbs.

Figure 34 displays the long-term trend in relation to desired conditions for Great Basin grassland based on the average treatment acres. Both **alternatives B and D** would reduce departure from desired conditions immediately, from high to no departure. **Alternative D** would remain within the no departure class; while **alternative B** would move from the no departure class to the low departure class after 50 years. Both **alternatives A and C** would produce movement away from desired conditions.

In summary, for the proposed average acre treatment objectives, when assessing movement toward desired conditions, **alternative B** does more to address the threats and risks within both the 15-year planning period followed by **alternative D**, then equally by **alternatives A and C**. However, when assessing movement toward desired conditions within the 50-year modeling period, **alternative D** does the most to address the threats and risks followed by **alternative B**, then equally by **alternatives A and C**.

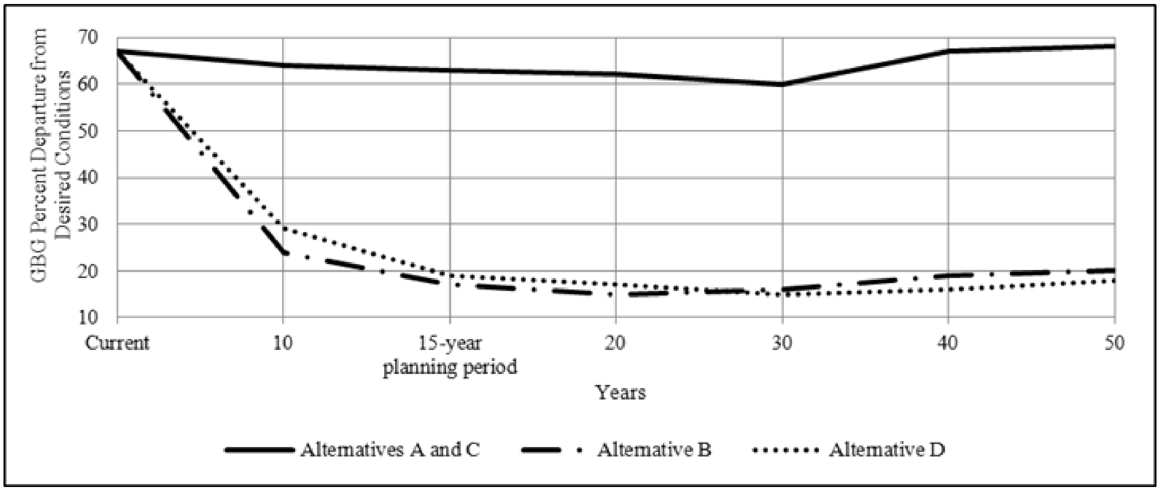

Figure 34. Great Basin grassland PNVT departure index from desired condition trend, over a 50-year time period, for the average treatment level

Semi-Desert Grassland PNVT

Based on the planned treatment objectives for each alternative (table 45), the departure index (DI) is expected to vary by alternative (table 46).

Table 45. Annual treatment objective levels (acres) by alternative in the semi-desert grassland PNVT

Alt.	High Treatment Objective Mechanical Treatment	High Treatment Objective Wildland Fire Treatment	Low Treatment Objective Mechanical Treatment	Low Treatment Objective Wildland Fire Treatment	Average Treatment Objective Mechanical Treatment	Average Treatment Objective Wildland Fire Treatment
A	—	—	—	—	0	27
B	0	3,000	0	2,000	0	2,500
C	0	0	0	0	0	0
D	0	3,000	0	2,000	0	2,500

Table 46. Fifteen-year (planning period) semi-desert grassland PNVT departure index (DI) by alternative treatment objective levels; current DI is H^{79}

Treatment Objective Level	Alt. A DI	Alt. B DI	Alt. C DI	Alt. D DI
High	—	H^{66}	—	H^{66}
Average	S^{84}	H^{68}	S^{84}	H^{68}
Low	—	H^{70}	—	H^{70}

N = no departure, L = low departure, M = moderate departure, H = high departure, S = severe departure

After one planning period, the proposed high acreage treatments under **alternatives B and D** would produce the greatest movement toward desired conditions, from the current rating of 78 to

66 (table 46). However, there would be no change in DI class and the grassland would remain highly departed. The proposed average treatment objectives under **alternatives B and D** would produce the second greatest movement toward desired conditions, from the current rating of 78 to 68. Again, there would be no change in DI class and the grassland would remain highly departed. Under these alternatives, there would be a reduction in woody vegetation encroachment and some movement toward historic grassland conditions. Reduction in overstory canopy cover would favor shade intolerant herbaceous species. There would be no planned treatments under **alternative C** and minimal treatments under **alternative A**.

Under **alternatives A and C**, semi-desert grasslands would continue to trend away from desired conditions. There would still be encroaching shrubs and trees of all sizes with open and closed canopies and not enough open, dense stands of perennial grasses and forbs (late seral).

Figure 35 displays the long-term trend in relation to desired conditions for semi-desert grassland based on the average treatment acres. **Alternatives B and D** would produce reductions in departure from desired conditions from high to moderate by year 30; the DI class would remain the same through the long term. **Alternatives A and C** would produce movement away from desired conditions; the PNVT would transition from highly to severely departed. **Alternatives B and D** would do the most to address the threats and risks to the semi-desert grassland PNVT within the planning period than the other alternatives. However, around year 40 trend changes very little in **all alternatives** and management changes would be needed to reset movement toward desired conditions within this PNVT.

In summary, for the proposed average acre treatment objectives, when assessing movement toward desired conditions, **alternatives B** and **D** equally do the most to address the threats and risks to the semi-desert grassland PNVT by the end of the 15-year planning period and the 50-year modeling period, followed equally by **alternatives A** and **C.**

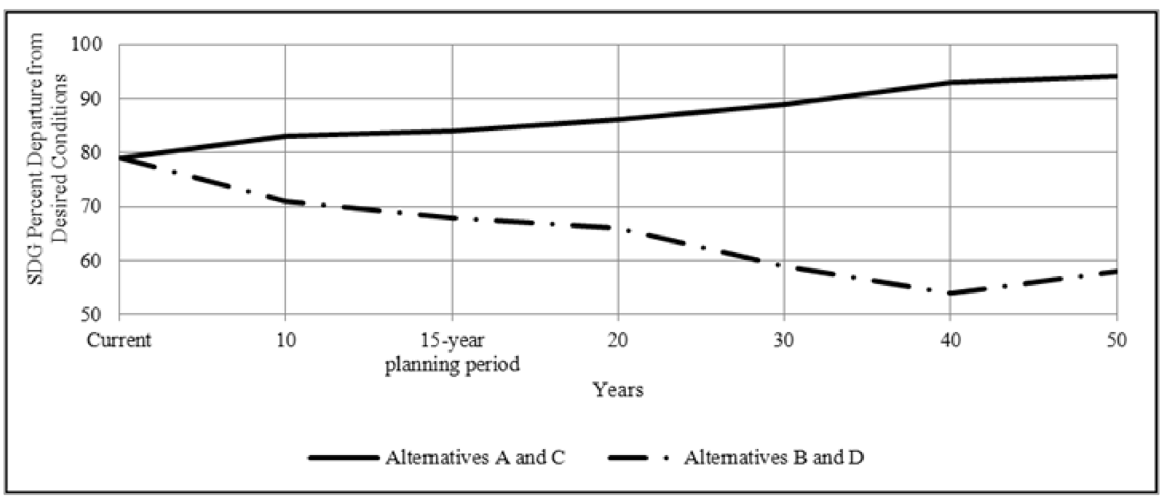

Figure 35. Semi-desert grassland PNVT departure index from desired condition trend, over a 50-year time period, for the average treatment level

Summary of Modeling Results Relative to Desired Conditions

When comparing the alternative average treatment acreages after one planning period (15 years) and across all modeled PNVTs (this includes the four forested, two woodland, and two grassland

PNVTs), the **action alternatives** display reductions from high to moderate departure from desired conditions.

Numerically, **all alternatives** average treatment acres would produce some movement toward desired conditions within the planning period. **Alternative D** would produce the greatest movement toward desired conditions when considering the modeling results across the eight PNVTs (from 64 DI at existing condition to 48 DI after 15 years). **Alternative B** would produce the second greatest movement in the direction toward desired conditions when considering the modeling results across the eight PNVTs (to a 49 DI after 15 years). Qualitatively, these are movements from high to moderate DI class.

Alternative C would produce the next greatest movement toward desired conditions when considering the modeling results across the eight PNVTs (to a 54 DI after 15 years). **Alternative A** would produce the least movement toward desired conditions (to a 57 DI after 15 years). Qualitatively, there would be no change in DI class for **alternatives C and A** when considering the modeling results across the eight PNVTs.

PNVTs Not Modeled with VDDT

Montane/Subalpine Grasslands

There are no specific objectives regarding this PNVT in **alternative A** other than a general statement on eliminating tree encroachment to maintain grasslands as suitable range. The **action alternatives** would treat approximately 500 acres per year to restore grassland conditions. Based on the treatment objectives (table 47), the vegetation outcome is described below.

Table 47. Annual treatment objectives (acres) by alternative in the montane/subalpine grasslands PNVT

Alternative	Mechanical Treatment	Wildland Fire Treatment
A	0	0
B	500	0
C	500	0
D	500	0

The **action alternatives** would provide equal benefit to the montane/subalpine grasslands. These alternatives have a 500-acre annual treatment objective through the planning period, specifically under **alternative C** for commercial tree removal where encroachment in the grasslands has occurred and under **alternatives B and D** for grassland restoration. Although not quantified, wildland fire (planned and unplanned ignitions) would also be emphasized under **alternatives B and D**. At this rate, treating the 10 percent tree encroached area of this PNVT would take approximately 11 years to complete. Since **alternative A** has no proposed treatment objectives, it would provide less benefit to these grasslands than **alternatives B, C, and D**.

The departure from desired conditions within these grasslands is rated as moderate and trending away. While removal of encroaching trees would be beneficial, they are a minor contributor to overall departure. In a study conducted on the Apache-Sitgreaves NFs, White (2002) found significant changes had occurred between 1913 and 1998 that were not related to woody species encroachment. These changes were in soil surface cover, exposed soil, herbaceous vegetation composition and cover, and dominant species composition. White determined that ungulate grazing (both livestock and elk) was the principal causal factor responsible for these changes, followed by fire suppression. The proposed treatment objectives under the **action alternatives** would not change this PNVT's departure class.

Changes in the structure and function of grassland systems have been noted as the primary cause of the loss of native diversity within grasslands (Stacey, 1995; Gori and Enquist, 2003). Finch (2004) identified and summarized the major threats to grassland biological diversity as the loss of natural fire cycles, overgrazing by livestock, prairie dog eradication, introduction of nonnative vegetation, woody species encroachment, erosion, and habitat fragmentation.

Interior Chaparral

There are no specific objectives for this PNVT in any **alternative**.

Since interior chaparral is not departed from desired conditions, the management approach under **all alternatives** would be to maintain this condition into the future, primarily by wildland fire (planned and unplanned ignitions). There would be no variation in environmental consequences between **alternatives.** The overstory and understory structure, composition, and function of the interior chaparral ecosystem would be expected to remain similar to current conditions during the planning period.

Effects to the capable grazing lands associated with interior chaparral are also estimated to remain similar to current conditions with approximately 45 percent of the herbaceous understory retained in moderately low ecological condition, while about half retained in moderately high ecological condition. Low to moderately low ecological conditions would result in lower levels of herbaceous vegetation ground cover and lower levels of growth, as well as species compositional shifts and changes in site potential. Lower growth levels would result in lower available forage for livestock and wildlife on those lands.

The interior chaparral has the lowest road density of all PNVTs. Effects to vegetation from roads are primarily from sediment leaving the road surface and concentration of road drainage causing rills and gullies resulting in loss of productivity. The road network would remain constant in **all alternatives** and would result in no difference in effects between alternatives.

Wetland/Cienega Riparian Areas and Riparian Forests

Based on the treatment objectives for each alternative (table 48), the vegetation outcome is described below.

Table 48. Average annual treatment objectives (acres) by alternative in the riparian PNVT

Alternative	Mechanical Treatment	Wildland Fire Treatment	Number of wetland/cienegas restored
A	0	0	0
B	0	350	15
C	0	0	0
D	0	450	15

As mentioned earlier, wetland/cienega riparian areas and riparian forest PNVTs have no to low departure from desired conditions. There are no specific objectives regarding treating the vegetation structures and compositions of these PNVTs in **alternative A or C**. **Alternatives B and D** propose to restore 200 to 500 acres and 300 to 600 acres annually. **Alternatives B and D** also have an objective to restore 5 to 25 wetland/cienega riparian areas during the planning period and would, therefore, have a greater benefit than **alternatives A or C**.

If treatments include removal of non-riparian woody and herbaceous species, **alternatives B and D** would provide the greater benefit to all of the riparian PNVTs. The **action alternatives** propose to reduce animal damage on 5 miles of riparian area annually. This should reduce ungulate damage to willows and other riparian woody species.

Again, **alternatives B and D** have an objective to restore 5 to 25 wetland/cienega riparian areas during the planning period and would, therefore, have a greater benefit than either **alternative A or C**.

The riparian areas and riparian forest PNVTs have some of the highest road densities on the forests, ranging from 1.8 to 3.4 linear miles of road per square mile. All **action alternatives** propose to remove unauthorized routes during the planning period. In this regard, **alternative D** would produce the greatest benefit by removing the most roads, followed by **alternative B, and then C**. Since roads are the main source of erosion and sediment; removal would eliminate direct deposition of sediment into the riparian areas. **Alternative A** does not contain specific objectives to remove roads for the benefit of riparian areas; there would continue to be the threat of erosion from existing roads and sedimentation into the riparian areas. See table 49 below.

Table 49. Road treatment objectives (miles) by alternative in the riparian PNVT

Objective Description	A	B	C	D
Minimum amount of NFS roads or trails that negatively impact streams or riparian areas to be relocated, repaired, improved, or decommissioned	0	4	0	4
Average amount of unauthorized roads or trails that negatively impact streams or riparian areas to be removed	0	2	3	3

Aspen

All alternatives have the desired condition to retain aspen on the landscape. This would entail actions to maintain and regenerate aspen at the desired condition level of roughly 50,000 acres or more during the planning period (compared to current condition of aspen at 76,500 acres). Aspen readily regenerates after disturbance like fire. Actions to maintain aspen include fencing or other browsing controls and removal of conifer encroachment within aspen clones.

All alternatives would maintain aspen at desired conditions during the planning period (table 50). The level of aspen, as a consequence of forest management and activities, could be further affected by actions outside of Forest Service control. Primary examples of aspen loss not related to forest management and activities, and occurring now, include ungulate browsing of aspen seedlings and saplings, insects and disease, and sudden aspen decline (SAD).

Table 50. Acres of aspen at the end of the planning period, by treatment objective level and alternative; desired condition is 50,000 acres or more of aspen

Treatment Objective Level	Alt. A Acres	Alt. B Acres	Alt. C Acres	Alt. D Acres
High	—	65,696	61,049	61,793
Average	71,076	68,204	65,796	65,517
Low	—	70,711	70,542	69,241

Overstory and Herbaceous Understory Vegetation Cover Relationship

One of the most distinctive features of frequent-fire forests, woodlands, and grasslands of the Apache-Sitgreaves NFs is the major contribution the understory vegetation (grasses, forbs, shrubs) makes to ecosystem diversity and productivity. According to Laughlin and Grace (2006), in the absence of fire, the density of overstory trees increases which can reduce the diversity of understory vegetation 10 to 30 percent. Restoration efforts on the Apache-Sitgreaves NFs focus on the enhancement and/or recovery of native herbaceous species.

This section summarizes the environmental consequences that would occur as overstory canopy cover moves toward or away from desired conditions. These consequences can be applied to alternative outcomes presented in the following sections. The following sections present potential changes between overstory (represented by canopy cover) and understory vegetation resulting from the different proposed alternative treatment levels.

As overstory canopy cover moves toward desired conditions with the reduction in overstory canopy cover and reintroduction of periodic fire in the ponderosa pine and dry mixed conifer forests, Madrean pine-oak and piñon-juniper woodlands, and Great Basin and semi-desert grasslands, understory species diversity, cover, composition, and production would increase. Laughlin et al. (2005) found that low intensity surface fire is an important ecological disturbance in lower montane and subalpine forests that maintains understory communities within the range of natural variability and appears to promote species diversity. According to several authors (Bailey and Copeland, 1961; Blackburn et al., 1986; Knight, 1993), species composition is a clear indicator of hydrologic function. Hydrologic function is the capacity of a site to capture, store, and release moisture, and its ability to withstand and recover from capacity reducing events (Pellant et al., 2000).

The significance of changes in vegetation composition and structure is their relation to ecosystem function and process—litter and root biomass of herbaceous vegetation build and enrich soils at a far greater rate than in adjacent forested or woodland sites (Aber and Melillo, 1991) or areas now encroached by trees. Within southwestern ponderosa pine forests, Kaye and Hart (1998) reported that net rates of nitrogen transformation beneath relict grassy openings were twice those beneath post-settlement pines. Other studies have identified some understory vegetation components that may function as major community and ecosystem drivers (Nilsson and Wardle, 2005).

As overstory canopy cover moves away from desired conditions (greater than 10 percent in grasslands and 30 percent in forests and woodlands), there would continue to be negative environmental consequences. Shifts in compositions that change the vegetative structure from herbaceous species to woody species have effects on levels of surface runoff and soil loss (McGinty et al., 1995).

Ecologically, the most far reaching, long-term negative effect due to shifts in grass and woody plant abundance is loss of soil, soil productivity, and species diversity. For grassland soils, 10 to 94 percent are in impaired and/or unsatisfactory condition, much of this can be attributed directly to the loss of herbaceous vegetation. According to Friedel (1991), once grass has been displaced, this alteration may result in a difficult to reverse conversion to woody vegetation. Soil erosion can irreversibly alter the physical, chemical, and biological properties of the soil (CRC, 1994) and, in turn, alter the kind and amount of vegetation a site can support.

Vegetation species compositional shifts have occurred within all PNVTs (White, 2002; Vander Lee et al., 2006), a decreasing understory species diversity. The effect of the loss of a species on an ecosystem is the result of both the loss of the direct effects of the organism on ecosystem functioning, and the response of other organisms to that loss. These effects and responses occur through numerous mechanisms (e.g., species can directly affect soil nutrient and water content through varying root mass). In addition, specific species can alter plant community composition through competition and associated effects which, in turn, may affect ecosystem function.

Forested PNVTs

Ponderosa pine forest: Within the 15-year planning period, **all alternatives** would produce a reduction in closed canopy acres (figure 36). However, **alternative C** would reduce the closed canopy cover on the greatest number of acres, from 410,912 to 324,765 acres, a 21 percent reduction. **Alternatives B, A, and D** would result in 13, 10, and 8 percent reductions, respectively. At the end of 50 years, the alternatives would have reduced closed canopy acres by 24, 21, 18, and 16 percent for **alternatives C, D, B, and A**, respectively.

Understory vegetation cover has been directly related to time since fire and ponderosa pine basal area (Laughlin et al., 2005). There should be an increase in understory plant cover, richness, diversity, and heterogeneity in this PNVT from canopy cover reductions through mechanized thinning and periodic fire. With expected increases in herbaceous plant vigor through decreased competition for sunlight and moisture and more rapid nutrient cycling by fire, there could be greater herbage growth. Current average herbaceous cover (45 to 78 percent) could increase by as much as 27 percent. Average estimated production (255 to 387 pounds per acre) has the potential to increase by as much as 39. Given the opportunity to respond to overstory canopy reduction, the existing understory of low and moderately low ecological conditions or very poor and poor range conditions occur on more than 480,000 acres should move to higher ecological levels and closer to desired conditions.

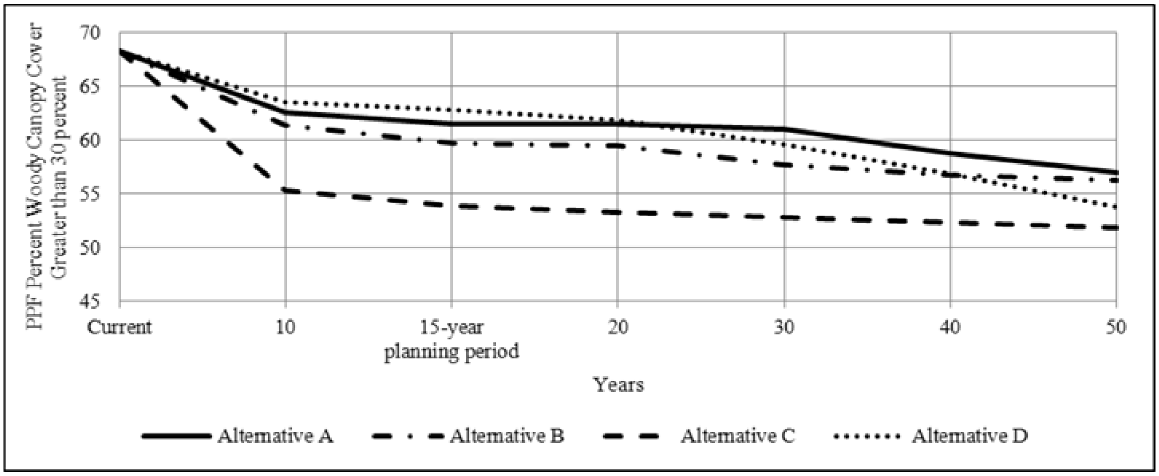

Figure 36. Percent of ponderosa pine PNVT with canopy cover greater than 30 percent over a 50-year timeframe by alternative

Wet mixed conifer forest: Wet mixed conifer is a naturally closed canopy forest; desired conditions are for no more than 21 percent (37,379 acres) of this PNVT with open canopy cover. Within the 15-year planning period and over 50 years, **all alternatives** would increase closed canopy acres (figure 37). **Alternatives A, B, and D** would increase closed canopy acres from 101,457 to 113,917, a nearly 12 percent increase. **Alternative C** would increase in closed canopy acres roughly 5 percent, from 101,457 to 106,797 acres. At the end of 50 years, closed canopy acres would increase by 19, 18, 17, and 14 percent, for **alternatives B, A, D, and C**, respectively.

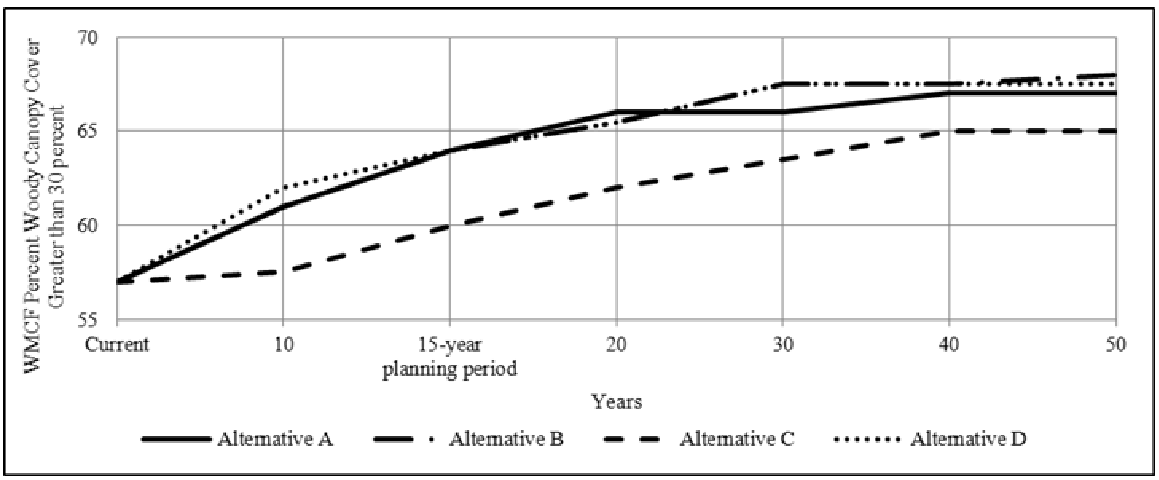

Figure 37. Percent of wet mixed conifer PNVT with canopy cover greater than 30 percent over a 50-year timeframe by alternative

As a result of canopy cover increases within this PNVT, there would be very little change in understory plant cover, richness, diversity, and heterogeneity from current conditions. Current average herbaceous cover (73 to 94 percent) and average estimated production (59 to 136 pounds per acre) would not increase. Overstory canopy increase would facilitate minimal, if any, movement of the existing understory situation where low and moderately low ecological conditions occur on more than 60,000 acres to higher ecological levels and closer to desired conditions; in fact, the opposite is more likely to occur.

Dry mixed conifer forest: Dry mixed conifer is a naturally open canopied forest; desired conditions are for 68 percent (100,562 acres) of this PNVT with open canopy cover. Within the planning period **all alternatives** proposed average acre treatment objectives would increase closed canopy acres (figure 38). **Alternative C** yields the smallest increase in closed canopy acres, from 90,210 to 107,217 acres, a 19 percent increase (figure 37); **alternatives B and A** follow with 20 and 23 percent increases, respectively. At the end of 50 years, closed canopy acres would increase by 20, 21, 22, and 26 percent for **alternatives B, A, C, and D**, respectively. Under **all alternative**s, insufficient acres would be treated within this PNVT to achieve desired conditions.

As a result of canopy cover increases within this PNVT there would be little change in understory plant cover, richness, diversity, and heterogeneity. Current average herbaceous cover (57 to 89 percent) and average estimated production (206 to 497 pounds per acre) would not increase. Overstory canopy increase would facilitate minimal, if any, movement of the existing understory situation where low and moderately low ecological conditions occur on more than 81,000 acres to higher ecological levels and closer to potential; in fact, the opposite is more likely to occur.

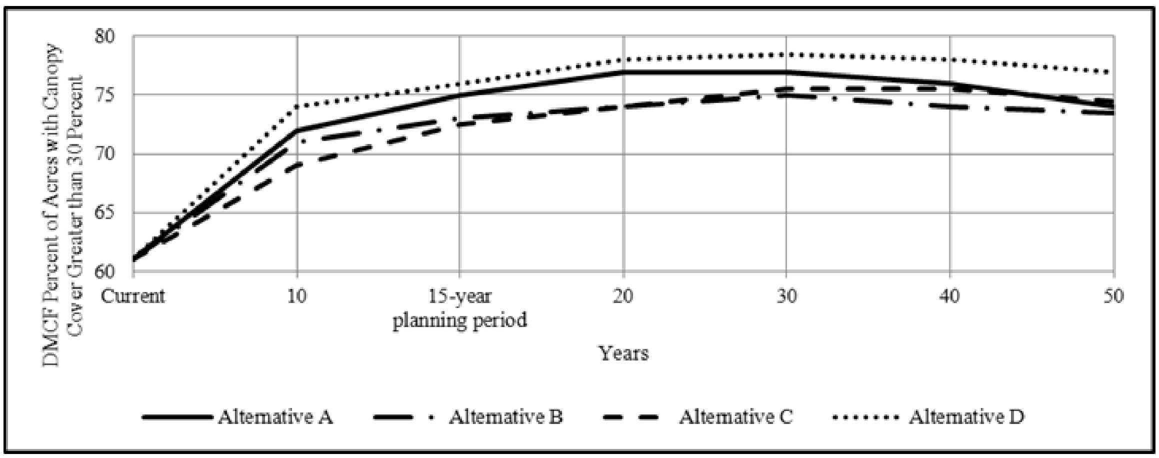

Figure 38. Percent of dry mixed conifer PNVT with canopy cover greater than 30 percent over a 50-year timeframe by alternative

Spruce-fir forest: Spruce-fir is a naturally closed canopy forest; desired conditions are to have no more than 19 percent (3,357 acres) of this PNVT with open canopy cover. Within the 15-year planning period, **all alternatives** would increase closed canopy acres (figure 39). **Alternative A** would produce the greatest increase from 10,777 to 12,014 acres, an 11 percent increase. **Alternative B** would increase closed canopy acres to 11,925, a nearly 11 percent increase. **Alternative D** would increase closed canopy acres to 11,837, a nearly 10 percent increase. **Alternative C** would increase closed canopy acres the least from 10,777 to 11,749 acres, a 9 percent increase. Desired conditions for this PNVT are to have roughly 81 percent or 14,310 acres with closed canopy cover. However, at the end of 50 years, **all alternatives** except **A** would decrease closed canopy acres. **Alternative A** would increase by 2 percent. **Alternative B** would decrease by 3 percent and **alternative C** would decrease by 4 percent, while **alternative D** would decrease by 7 percent. The number of years required to meet the canopy cover desired conditions for this entire PNVT would be 83 years, 41 years, 28 years, and 33 years, respectively, for **alternatives A, B, C, and D**.

As a result of canopy cover increases through mechanized thinning and introduction of some prescribed fire within this PNVT, there should be a small increase (at least in the short term) in understory plant cover, richness, diversity, and heterogeneity because of more rapid nutrient cycling by fire; there could be greater herbage growth. Current average herbaceous cover ranging (90 to 95 percent) and average estimated production (25 to 50 pounds per acre) could increase by as much as 6 and 8 percent for cover and production, respectively. Overstory canopy decrease may facilitate minimal movement of the existing understory situation where low and moderately low ecological conditions occur on more than 500 acres to higher ecological levels and closer to potential.

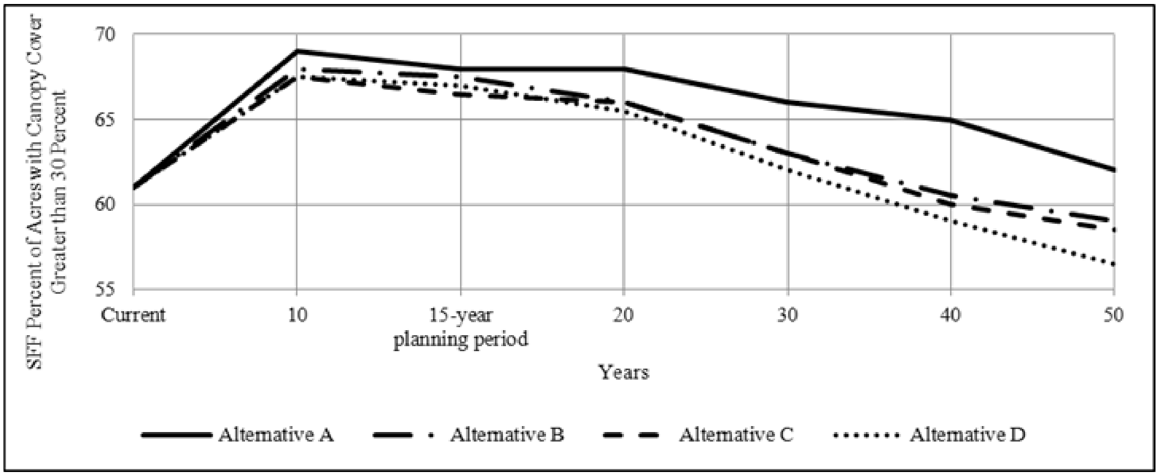

Figure 39. Percent of spruce-fir PNVT with canopy cover greater than 30 percent over a 50-year timeframe by alternative

Woodland PNVTs

Madrean pine-oak woodland: Madrean pine-oak is naturally an open-canopy woodland; desired conditions are for less than 21 percent (82,935 acres) of this PNVT with closed canopy cover. Within the planning period, **all alternative** proposed average acre treatment objectives would reduce in closed canopy acres (figure 40). However, **alternative D** reduces the closed woody canopy cover on the greatest number of acres, from 308,927 to 231,032 acres, a 25 percent reduction; **alternatives B, C, and A** follow with 15, 8, and 3 percent reductions, respectively. At the end of 50 years, closed woody canopy acres would be reduced by 42, 32, 24, and 6 percent for **alternatives D, B, C, and A**, respectively. Because this PNVT is predominantly roadless (93 percent) and has no suitable lands for timber production or mechanical harvest treatments, fire is the only management tool available. Under **all alternatives**, an insufficient number of acres would be treated or prescribed fire treatments would be only partially effective in achieving desired conditions.

As a result of canopy cover reductions through thinning with periodic fire, within this PNVT, understory plant cover, richness, diversity, and heterogeneity should increase. With expected increases in herbaceous plant vigor through decreased competition for sunlight and moisture and more rapid nutrient cycling by fire, herbage growth could be greater. Current average herbaceous cover (6 to 35 percent) and average estimated production (102 to 154 pounds per acre) could increase by as much as 43 and 79 percent for cover and production, respectively. Given the opportunity to respond to overstory canopy reduction, the existing understory state of affairs where low and moderately low ecological conditions or very poor and poor range conditions occur on more than 100,000 acres, should enable some movement to higher ecological levels and closer to desired conditions.

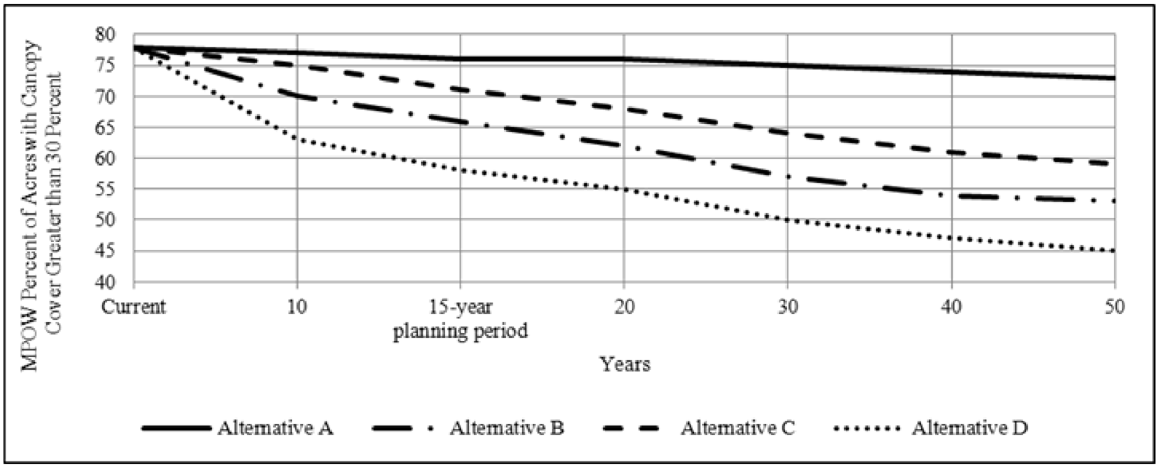

Figure 40. Percent of Madrean pine-oak PNVT with canopy cover greater than 30 percent over a 50-year timeframe by alternative

Piñon-juniper woodland: The majority of the piñon-juniper on the Apache-Sitgreaves NFs is naturally open canopy woodland; desired conditions are for less than 28 percent (62,204 acres) of this PNVT with closed woody canopy cover. Within the planning period, **all alternative** proposed average acre treatment objectives increase closed canopy acres (figure 41). However, **alternative D** yields the smallest increase in closed canopy acres, from 48,877 to 64,428 acres, a 32 percent increase. **Alternatives B, C, and A** follow with 52, 61, and 82 percent increases in closed canopy acres, respectively. By the end of the 50-year modeling period, closed canopy acres would increase by as much as 70, 116, 145, and 191 percent for **alternatives D, B, C, and A**, respectively. Under **all alternatives**, insufficient acres would be treated to achieve the desired conditions over time. At the proposed treatment rates, it would take approximately 377 years, 79 years, 74 years, and 53 years for **alternatives A, B, C, and D**, respectively, to treat the entire PNVT; natural regeneration and growth may occur at a rate greater than treatment removal.

As a result of canopy cover increases within this PNVT, understory plant cover, richness, diversity, and heterogeneity should decrease. With herbaceous plant vigor decreases from increased competition for sunlight and moisture and slower nutrient cycling by fire, herbage growth should be less. Current average herbaceous cover (17 to 37 percent) and average estimated production (101 to 224 pounds per acre) could increase by as much as 60 and 73 percent for cover and production, respectively. Overstory canopy increase would not facilitate movement of the existing understory situation where low and moderately low ecological conditions occur on more than 192,000 acres, to higher ecological levels and closer to desired conditions.

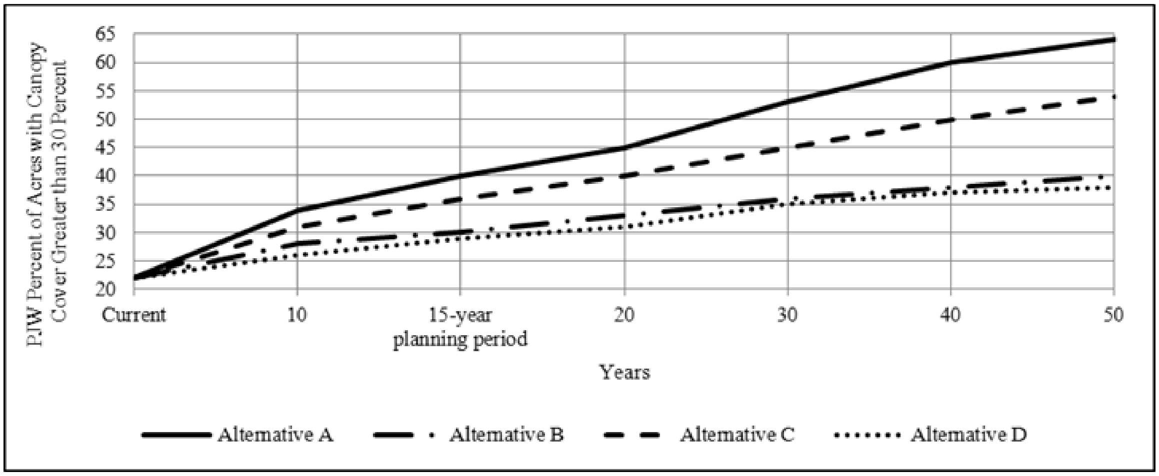

Figure 41. Percent of piñon-juniper PNVT with canopy cover greater than 30 percent over a 50-year timeframe by alternative

Grassland PNVTs

Grasslands are dominated by grasses, grass-like plants, and/or forbs and are maintained in this condition by natural successional processes, primarily drought and fire. Grasslands should not have a woody species component contributing greater than 10 percent of the overall canopy cover. Herbaceous vegetation provides critical soil cover and hiding cover and shelter for small wildlife. In addition, open grasslands have the potential to produce from 6 to 110 times the herbaceous biomass per acre than adjacent forested areas (Laing et al., 1987).

Great Basin grassland: Great Basin grassland is naturally an open herbaceous vegetation dominated PNVT; desired conditions are to have less than 22 percent (40,815 acres) with closed woody canopy cover. Within the planning period, **all alternatives** proposed average acre treatment objectives would reduce in woody canopy acres (figure 42). However, **alternative B** reduces the woody canopy cover on the greatest number of acres, from 165,190 to 61,223 acres, a 63 percent reduction. **Alternative D** follows with a 57 percent reduction in closed canopy cover. Under **alternatives A and C,** closed woody canopy acres are reduced by 5 and 7 percent, respectively. By the end of the 50-year modeling period, **all alternative** proposed average acre treatment objectives would reduce woody canopy acres. **Alternative D** reduces the woody canopy cover on the greatest number of acres, from 165,190 to 69,571 acres, a 58 percent reduction, **alternative B** follows with a 56 percent reduction in closed canopy cover. Under **alternatives A and C** closed woody canopy acres are reduced by 2 and 8 percent, respectively. Under **alternatives A and C,** insufficient acres would be treated to achieve the desired conditions. Around year 40, management actions under **alternatives B and D** would need to change to continue to reduce closed woody canopy acres.

As a result of woody canopy cover elimination through mechanized thinning and introduction of periodic fire, understory plant cover, richness, diversity, and heterogeneity should increase. With expected herbaceous plant vigor increases through decreased competition for sunlight and moisture and more rapid nutrient cycling by fire, herbage growth could be greater. Current average herbaceous cover (23 to 45 percent) and average estimated production (258 to 440 pounds per acre could increase by as much as 46 and 66 percent for cover and production, respectively. Overall, woody overstory canopy elimination should facilitate movement of the existing understory situation where low and moderately low ecological conditions occur on more than 160,000 acres, to higher ecological levels and closer to desired conditions.

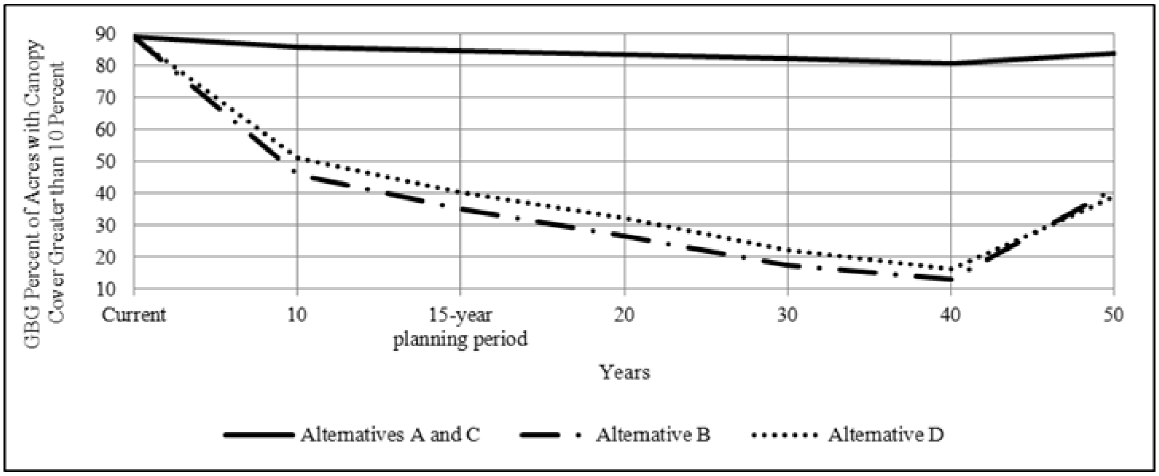

Figure 42. Percent of Great Basin grassland PNVT with canopy cover greater than 10 percent over a 50-year timeframe by alternative

Semi-desert grassland: Semi-desert grassland is naturally an open herbaceous vegetation dominated PNVT; desired conditions are for less than 10 percent (10,695 acres) of this PNVT with closed woody canopy cover. By the end of the 15-year planning period, both **alternatives B and D** proposed average acre treatment objectives would reduce closed woody canopy acres (figure 43) from 84,492 to 70,588 acres, a 16 percent reduction. However, under both **alternatives A and C,** closed woody canopy acres would increase by 6 and 4 percent, respectively. By the end of the 50-year modeling period, **alternatives B and D** would reduce closed woody canopy acres by 30 percent, while under **alternatives A and C** closed woody canopy acres would increase by an additional 19 and 16 percent, respectively.

As a result of woody canopy cover elimination through the introduction of periodic fire , under **alternatives B and D** understory plant cover, richness, diversity, and heterogeneity should increase. With herbaceous plant vigor increases from decreased competition for sunlight and moisture and more rapid nutrient cycling by fire, herbage growth could be greater. Current average herbaceous cover (7 to 16 percent) and average estimated production (52 to 107 pounds per acre) could increase by as much as 56 and 89 percent for cover and production, respectively. Overall, woody overstory canopy elimination should facilitate movement of the existing understory situation where low and moderately low ecological conditions occur on more than 44,800 acres, to higher ecological levels and closer to desired conditions.

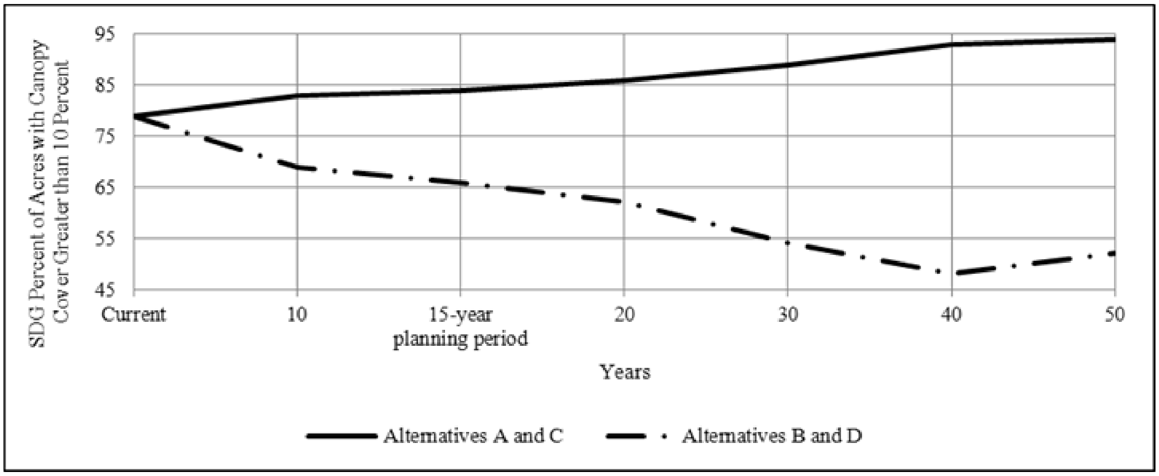

Figure 43. Percent of semi-desert grassland PNVT with canopy cover greater than 10 percent over a 50-year timeframe by alternative

Climate Change

Restoring and maintaining PNVT resilience would likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change impacts and variability (Forest Service, 2010h). The alternative that makes the most progress toward desired conditions and historic fire regimes would provide the most resiliency and adaptation to climate change for all 14 PNVTs on the forests. Climate change is likely to exacerbate the effects of natural and altered disturbance regimes, including wildfire, insect outbreaks, and flooding and erosion across all Apache-Sitgreaves NFs' PNVTs may prompt abrupt ecological changes.

Resilient and redundant resource conditions provide reasonable assurances of these PNVTs ability to adapt to the uncertainties of changing climate. Moving current forest, woodland, and grassland vegetation composition and structure toward their desired conditions and/or reference condition and restoring historic ecological disturbance regimes should make these PNVTs more functional, enabling them to be more resistant and resilient to uncertain future climate shifts and disturbance events. The closer ecological composition, structure, and process are to reference conditions, the more properly each PNVT is functioning and the more secure dependent species (plants and animals) are within the associated habitats. This is especially important with potential changes in the climate. The alternative that moves most toward desired conditions and, therefore, reduces in risk the most within the planning period is **alternative B**.

Reestablishing the ecological processes and patterns necessary to make these terrestrial ecosystems sustainable, resilient, and healthy under proposed restoration treatments and future climatic conditions is of primary importance to their continued existence or evolutionary ability to adapt. Based on this analysis when assessing each alternatives combined contribution toward achieving desired conditions (i.e., modeled movement toward desired conditions/reference conditions, acres of old/large trees, snags/acre, coarse woody debris, aspen retention, overstory and herbaceous understory), **alternative B** would move the most toward desired conditions. **Alternative B** would reduce risk the most. It would also increase the most resistance, resilience, and adaptive capacity of these PNVTs to absorb disturbances and to reorganize while undergoing change to retain essentially the same function, structure, identity, and feedback within the planning period. The other alternatives rank in order of contribution are **alternatives D, C, and A**, respectively.

Cumulative Environmental Consequences

The area boundary for this analysis is the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion (figure 44). This ecoregion shares common climatic and vegetation characteristics.

The sum of past management actions over time has resulted in the departure of most PNVTs from their characteristic vegetation states on and around the Apache-Sitgreaves NFs. These departures are largely due to fire suppression, in conjunction with past, unsustainable timber and grazing practices, and other anthropogenic disturbances of natural processes. The results are a dramatic increase in stand-replacing fires, particularly since the mid-1990s, decreases in water yields, degradation of aspen stands, and woody species encroachment of grasslands. Departures from reference conditions exist in all PNVTs on the forests, and most continue to trend further from reference conditions.

The Coconino, Kaibab, and Prescott NFs are updating their land management plans. Neighboring national forests, tribal, State, and BLM lands are located within this ecoregion and are also conducting treatments within vegetative communities very similar to those on the Apache-Sitgreaves NFs. Vegetation treatments include both mechanical (e.g., commercial harvesting, thinning, planting) and wildland fire. One of the largest foreseeable projects is the Four-Forest Restoration Initiative (4FRI), a planning effort designed to restore forest resiliency and function across four national forests in Arizona: Apache-Sitgreaves, Coconino, Kaibab, and Tonto (figure 45). The first restoration activities would occur on approximately 600,000 acres on the Coconino and Kaibab NFs. If successful, this effort could decrease susceptibility to large and uncharacteristic disturbances, increase water yields from winter snowfall through the creation of interspaces, and provide long-term carbon sequestration in large old trees at a scale meaningful to improving the resiliency and ability to adapt to climate change in the ponderosa pine forests of the Southwest. The Gila NF is also managing for improved ecosystem health, movement toward reference conditions, and reduction of fire risk. The White Mountain and San Carlos Apache Tribes also continue to manage their lands for multiple resource purposes. Management within these lands has been directed at reducing fire risks.

Agencies within the State of Arizona (i.e., Department of Transportation, Game and Fish Department) and neighboring Federal, state, and tribal land managers have programs to eradicate or limit the spread of invasive plants and animals.

The cumulative environmental consequences of proposed management under **all alternatives** in the context of the larger ecoregion would contribute to the movement of vegetation toward desired conditions. These efforts would contribute to landscape restoration, control of invasive species, a reduction in uncharacteristic wildfire across the broader landscape, and the resiliency of these PNVTs to adapt to climate change.

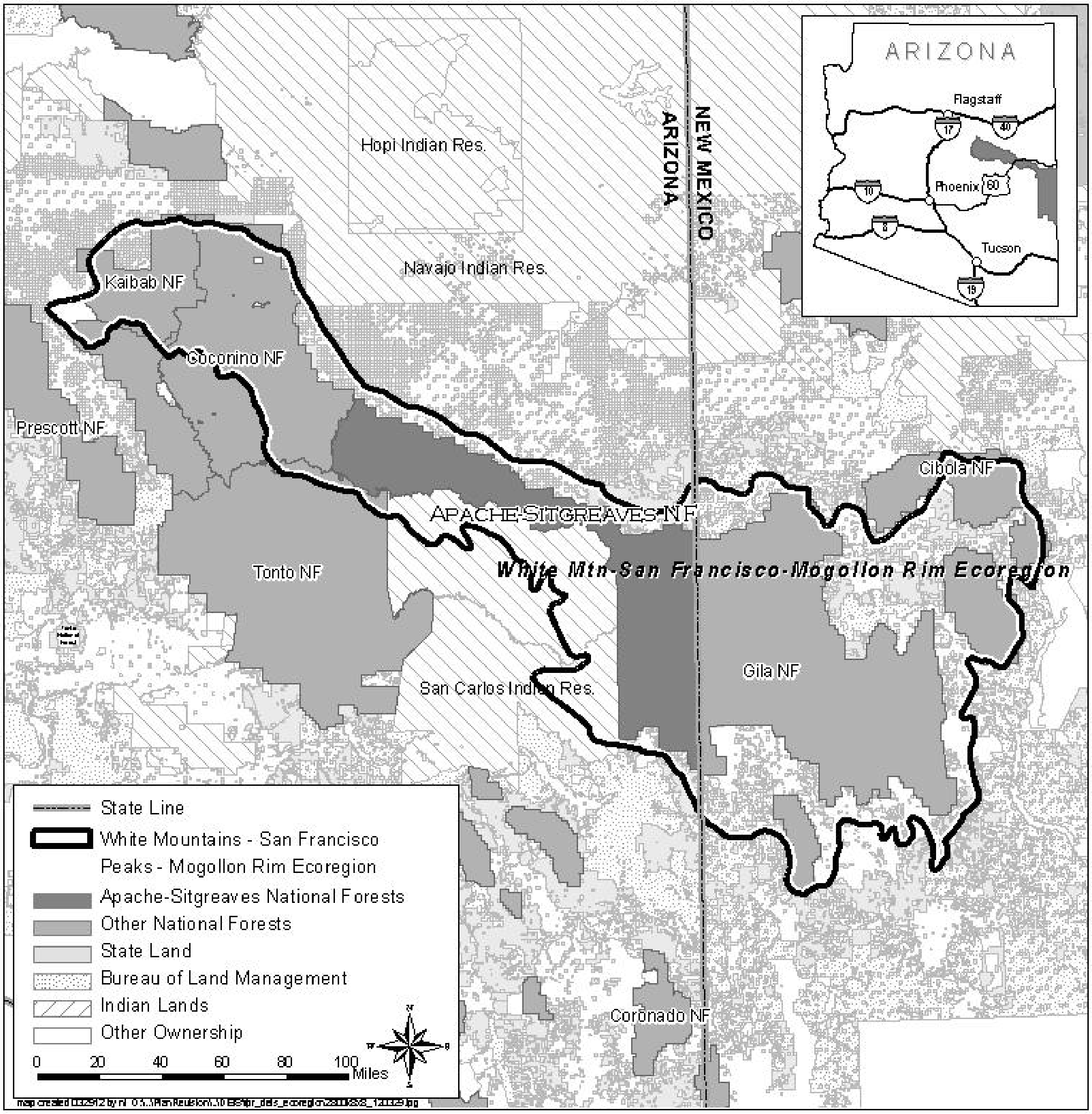

Figure 44. Map of White Mountains-San Francisco Peaks-Mogollon Rim Ecoregion

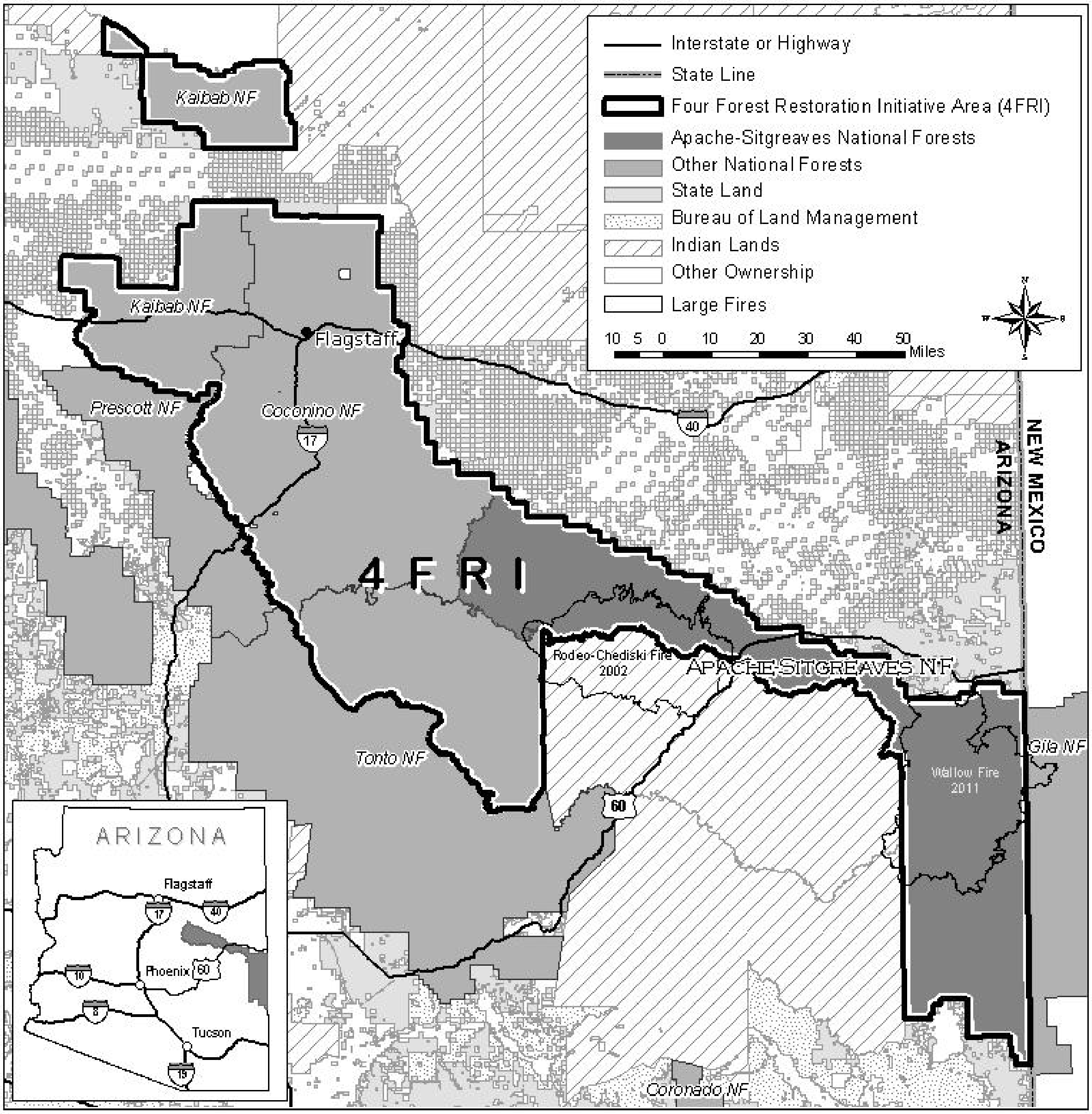

Figure 45. Map of Four Forest Restoration Initiative (4FRI) boundary

Forest Health

This section discusses the roles and impacts of tree dependent insects and disease on the forests' health. It examines the risk of tree loss caused by insects and disease resulting from management activities or lack of management activities by alternative. For the purposes of this analysis, forest health concerns are grouped into five categories: bark beetles, defoliators, aspen decline, persistent diseases, and new invasive species. This analysis covers ponderosa pine, dry mixed conifer, wet mixed conifer, and spruce-fir forested PNVTs and piñon-juniper woodland PNVT. The analysis relies heavily on a report prepared by Lynch et al. (2010). The full analysis for this topic can be found in the "Forest Health Specialist Report" (Forest Service, 2014h) available in the "Plan Set of Documents."

Because no new insect-disease surveys have been conducted after the 2011 Wallow Fire, assumptions include the following:

- The percentages of affected lands stated in Lynch et al. (2010) include both Apache-Sitgreaves NFs and Fort Apache Tribal Reservation lands across east-central Arizona which collectively are valid for application to the Apache-Sitgreaves NFs.
- The existing insect-disease activity described in Lynch et al. (2010) is still representative for all forest and woodland acres not burned by high or moderate severity fire in the Wallow Fire.
- Portions of existing insect and disease populations were reduced directly by the Wallow Fire or indirectly by the fire's reduction of their obligate host tree species and forest structure.
- All localized populations of insect-disease species were temporarily eliminated from areas now deforested.
- Dwarf mistletoe infection levels in trees surviving the Wallow Fire on moderate or low severity burned acres may be reduced due to scorched lower limbs (Conklin et al., 2009).
- Some insects, like bark beetles, will thrive as they take advantage of fire-killed and/or fire-stressed trees. The resulting insect population irruptions could threaten more live trees within and adjacent to burned areas (Anhold, 2011; Parker et al., 2006).
- Existing insect/disease species and their hosts remain near the severely burned areas, such that reestablishment of infestation/infection would occur in burned areas as the host trees and conditions again become favorable.
- When the structures and tree species compositions for all vegetation states are in the desired condition proportions for each potential natural vegetation type (PNVT), native insects and diseases function in their natural ecosystem roles. All alternatives are designed to manage toward the same desired conditions.

Affected Environment

Approximately 22 percent of all forested PNVT acres are currently deforested as a result of high severity wildfire and other uncharacteristic disturbances (see the "Forest Products" section for more information). The following affected environment descriptions are for the remaining 78 percent of lands that still support tree cover, ranging from early developmental to mature vegetation structural states.

Insects and Diseases

Insects and diseases are natural disturbance agents. Interactions can be very complex between them and their host tree species, the environment, and other pest species. Activity by these agents is always expected, although the extent and severity of damage can vary spatially and temporally. Due to the episodic nature of insect outbreaks, damage is evaluated over an extended period before designating any shorter period as "unusual." As documented by Lynch et al. (2010), a century-long record of insect and disease activity across the Apache-Sitgreaves NFs and the adjacent Fort Apache Indian Reservation gives some information on which species impact forests in east-central Arizona, how often outbreaks of insects and transitory pathogens might occur, and how much damage may be expected from insects and diseases.

All native insects and diseases play a natural role in the ecosystem within which they evolved. When forest conditions are within their natural range of variability, native insects and diseases generally survive at endemic levels and, thus, generally are not considered pests because they act as natural thinning agents, killing individual trees or small to large tree groups.

Insect and disease activity considered normal in forests of east-central Arizona includes the following:

- Bark beetle damage associated with localized tree disturbances (e.g., road building, harvesting, wind events, snow breakage, fire) in piñon-juniper woodland and ponderosa pine, mixed-conifer, and spruce-fir forests.
- Periodic localized outbreaks of *Dendroctonus* bark beetles, particularly western and roundheaded pine beetles, in large diameter ponderosa pine.
- Increased bark beetle activity during droughts in piñon-juniper and ponderosa pine, and to a lesser extent mixed conifer, where the timing and severity of damage is dependent upon host species, insect species, drought severity, length of drought conditions, and coincidence with other disturbance agents.
- Persistence of dwarf mistletoe infestations, including spread and intensification.
- Defoliation by native defoliating agents (e.g., western tent caterpillar, black leaf spot on aspen) and several defoliators in mixed conifer. Typically, except in aspen, damage from these agents is localized rather than widespread.

When forest conditions are departed from their natural range of variability, native insects and diseases can take advantage of resulting opportunities to increase their population levels and expand into new territory. If this continues, epidemic population levels can be reached. In such cases, they inflict greater damage or damage at a faster rate than their normal role in the ecosystem. They are considered pests whenever tree mortality exceeds stated management objectives. Likewise, nonnative insect or diseases can find opportunities to move into areas of weakened forest conditions and become established in the absence of natural controls that would resist or restrain them.

Insect activity in east-central Arizona's forests has increased in the last couple of decades. In most vegetation types, the acreage affected is greater than what was damaged during the 1950s drought period (Lynch et al., 2010). Insect and disease populations have responded to changing forest character (especially forest structure and tree species composition) and variability in climate.

Contemporary patterns of insect and disease activity in east-central Arizona have changed from pre-1950s regimes. These changes include the following:

- In ponderosa pine, *Ips* genus bark beetle species (pine engraver beetle and Arizona fivespined *ips*, which typically attack 3 to 12 inch diameter trees) became more prevalent and damaging than the drought responsive *Dendroctonus* genus bark beetle species (western pine beetle and roundheaded pine beetle, which typically attack 12 inch or greater diameter trees). The reverse occurred at the beginning of the 20th century.
- Damage to white fir by bark beetles and defoliators increased in all PNVTs where it occurs. The fir engraver beetle was not a significant damaging agent until the 1980s.

- Damage in the spruce-fir PNVT is unprecedented in the historical record, in terms of the severity of damage and the identity and variety of insects causing damage. Engelmann spruce has especially suffered unprecedented damage from several insects including native (and previously innocuous) defoliators such as loopers, an invasive foliar aphid, and an aggressive bark beetle outbreak. These species' populations may be influenced by warm temperatures.
- Over the past decade, widespread mortality of mature aspen occurred due to a combination of drought, frost, and defoliation events, in conjunction with conifer competition and failure of aspen regeneration to recruit to larger sizes because of herbivory and damage from domestic and wild ungulates such as Rocky Mountain elk.
- For piñon-juniper woodlands in east-central Arizona, the size and severity of drought and *Ips*-related piñon mortality in the early 2000s was unprecedented. It was six times larger than the 1990 outbreak, the first notable outbreak recorded for this area.
- Extensive areas of damaged piñon-juniper are becoming juniper woodlands or grasslands.
- In areas not recently burned, dwarf mistletoe occurrence and severity of infection have increased in ponderosa pine, Douglas-fir, and spruce. This increase is due to altered disturbance regimes and loss of forest openings and canopy gaps, resulting in more continuous forest canopy.
- Root/butt/stem decay diseases are a problem in developed recreation areas due to tree overmaturity and stress from soil compaction. These diseases exist across all forested PNVTs at varying amounts, but they have only been surveyed and documented in developed recreation sites.

Several of these changes in disturbance regimes appear to be responses to changes in forest structure and tree species composition that resulted from fire exclusion and past management practices. Drought also modifies disturbance regimes. Warming climate is a factor in spruce-fir forest health; however, its role in the other vegetation types is not yet known. All forest and woodland tree insects and diseases capitalize on changes in stand conditions that stress trees and make them more vulnerable. Changes in stand conditions may be caused by environmental factors (e.g., lightning, wildfire) and human actions (e.g., logging, fire damage). In addition, infestation by one insect or disease may predispose trees to attack by other damaging agents. For example, heavy dwarf mistletoe infection of ponderosa pine increases their susceptibility to attack by *Ips* beetles during drought (Kenaley et al., 2008).

Bark Beetles

The most destructive forest insects in western coniferous forests are bark beetles (Furniss and Carolin, 1977). During the past decade, a widespread bark beetle outbreak in ponderosa pine impacted more than 200,000 acres across east-central Arizona (figure 46).

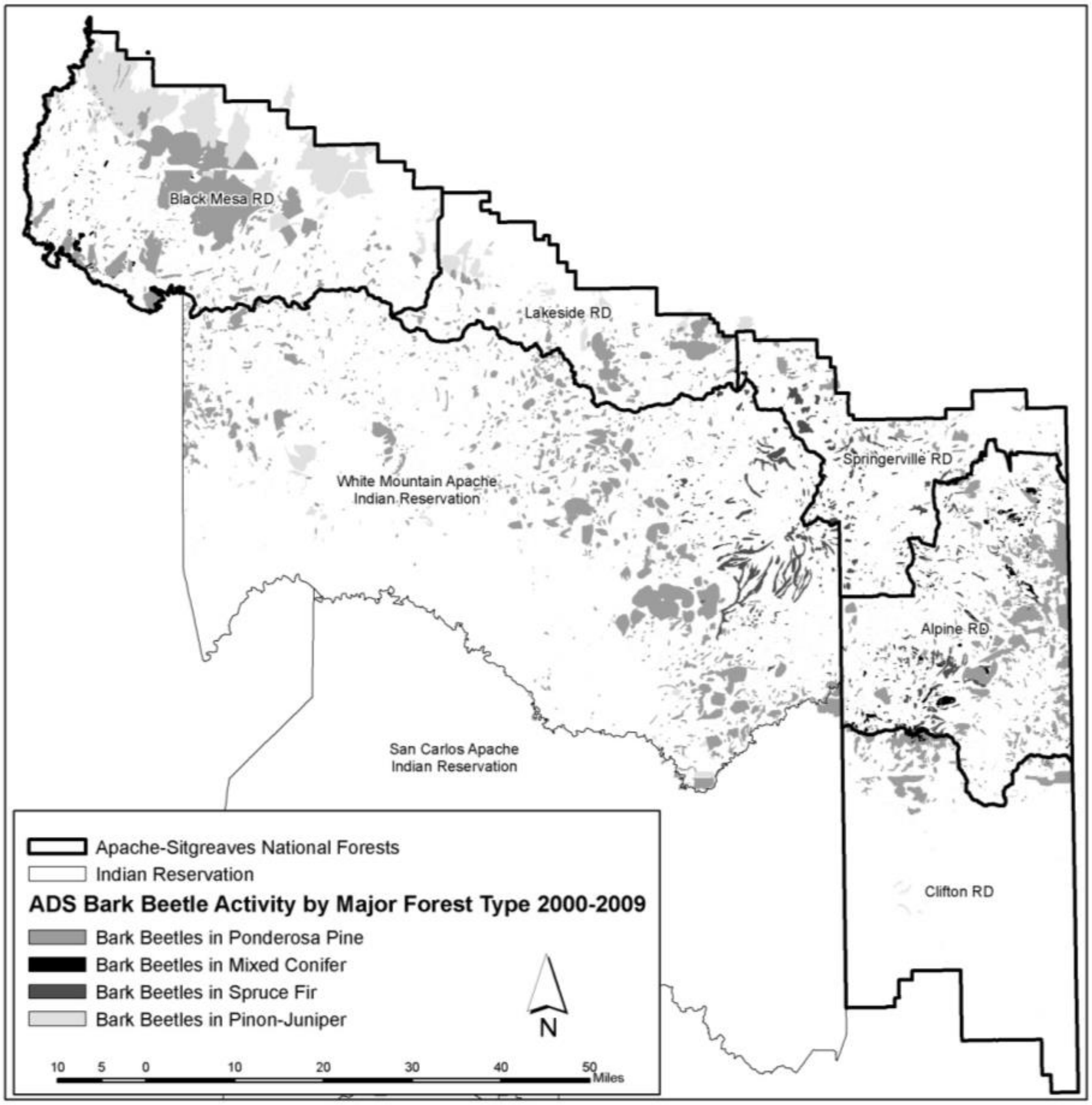

Figure 46. Map of bark beetle activity in east-central Arizona by major forest and woodland types from 2000-2009 compiled from annual Forest Service aerial detection surveys

Pine mortality during this time averaged approximately 9.6 percent by basal area and approached 100 percent in some stands. Douglas-fir beetle and fir engraver affected about 2,000 to 8,000 acres of mixed conifer annually, causing the mortality of entire groups of Douglas-fir and white fir (increases might be expected based on records of historical outbreaks). Nearly 40,000 acres of spruce have been impacted by spruce beetle, with related tree mortality in the past decade. Piñon *ips* activity occurred on more than 150,000 acres in the same timeframe, where tree mortality reduced piñon stand density by approximately 60 percent.

Numerous bark beetle species, which may attack almost all native conifers and some hardwood trees, exist across the Apache-Sitgreaves NFs' forest and woodland ecosystems. Beetle populations and corresponding tree mortality generally increase above endemic levels under the following conditions: drought; overstocked tree densities; stress caused by dwarf mistletoe, root decay fungi, or defoliating insects; and buildup of fresh, dead green wood as brood material across large areas. Brood material may result from logging/thinning slash left untreated onsite in consecutive years or from windthrow, fire, or other damaging agents.

Douglas-fir and spruce beetles are expected to increase attacks on large trees (12 inch or greater diameter) within and near the Wallow Fire burned area (Anhold, 2011) which would be a key concern for surviving patches of old growth, Mexican spotted owl habitat, and developed recreation sites in the mixed conifer and lower elevation spruce-fir PNVTs.

Defoliators

Defoliators weaken and sometimes kill trees by consuming the green needles or leaves. During the past decade, various defoliators have impacted over 300,000 acres across east-central Arizona (figure 47). Damage by native defoliators is typically localized rather than widespread, and recently most notable in the mixed conifer and spruce-fir types, especially on Mount Baldy and across the Alpine and Springerville Ranger Districts.

Key defoliators include aphids, loopers, western spruce budworm, western tent caterpillar, larvae of other moths and sawflies, black leaf spot, tip moths, and shoot borers. They generally do not kill trees outright unless outbreaks are intense and persist under the right conditions. Defoliators contribute to tree stress and decline, predisposing trees to mortality by other agents like bark beetles. Conditions which can lead to the most damaging outbreaks include warmer and drier weather patterns and/or climate shifts, dwarf mistletoe infection, abundance of host tree species, uninterrupted multistoried or uneven-aged stand structure that occurs across large acreages, and host species encroachment into offsite vegetation types where they normally would not be found when natural processes are functioning correctly (Hanavan and Boehning, 2010).

Cumulatively, Mount Baldy Wilderness is the area most affected on the Apache-Sitgreaves NFs by recent outbreaks of several major defoliators. The high number of resulting dead trees has greatly increased the fire hazard in the wilderness. Portions of the other two wilderness areas are also affected, but to a lesser extent. Mount Baldy Wilderness is the only wilderness area not burned by the Wallow Fire.

Aspen Mortality

Figure 48 illustrates non-wildfire aspen mortality from 2008 to 2009. Mortality is shown in context of aspen occurrence across the area. In those 2 years, the Apache-Sitgreaves NFs lost 27,541 acres of aspen to factors other than tree cutting or wildfire. Much of this mortality was mapped in previous years as aspen damage, indicative of true aspen decline. Numerous factors have been documented as contributors to aspen decline (see the “Vegetation” section).

Although aspen trees typically mature after about age 80, they can persist for more than 200 years in the West (DeByle and Winokur, 1985). Root systems can persist much longer, although no good method has been developed to determine the age of aspen roots. Pure aspen forests do not burn readily; however, above ground, aspen trees can be easily killed by fire of even the lightest intensity due to their extremely thin bark (Debyle and Winokur, 1985). This species is adapted to

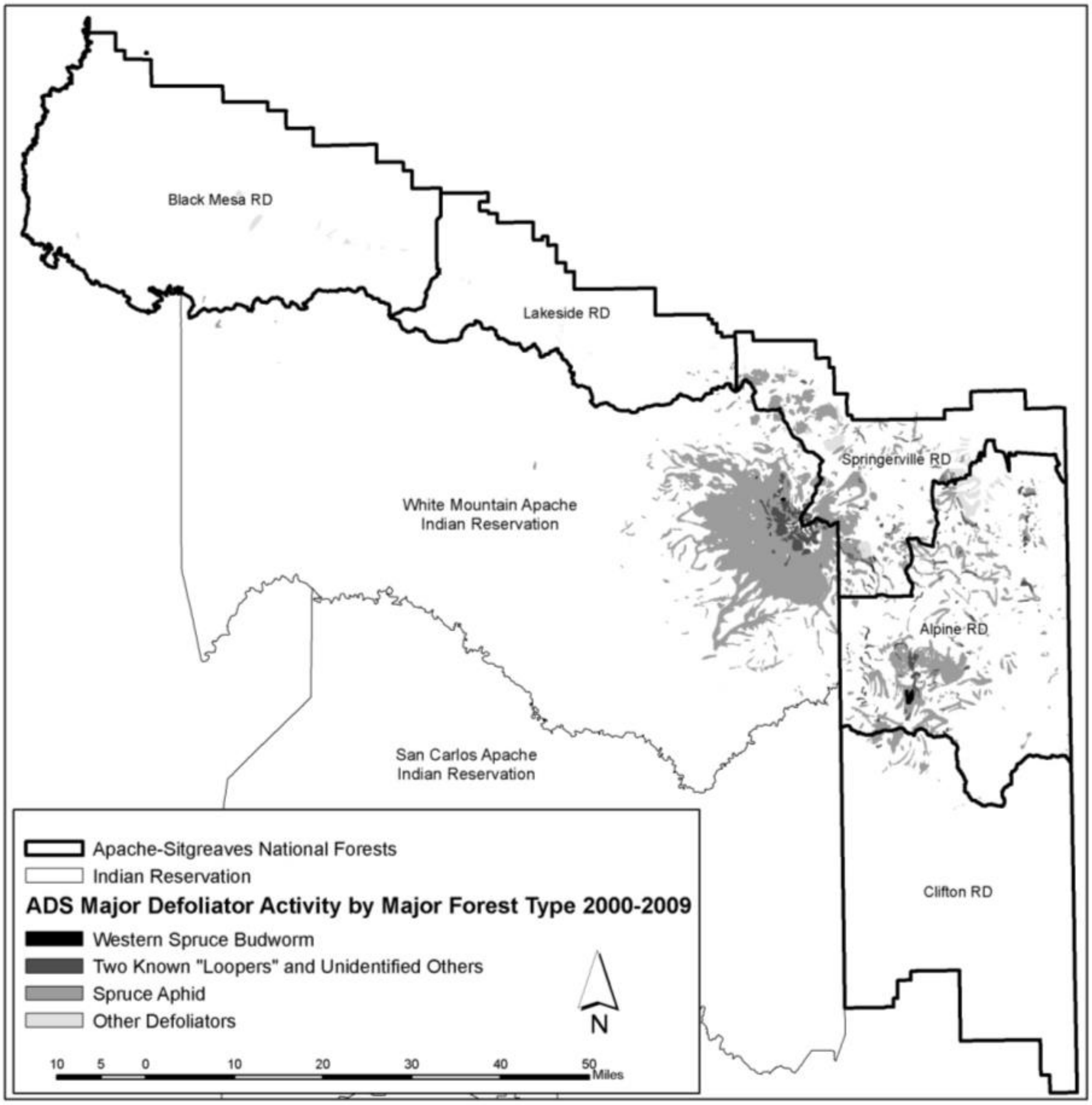

Figure 47. Map of major defoliator activity in east-central Arizona from 2000 to 2009 compiled from annual Forest Service aerial detection surveys

fire because its extensive root system has the ability to survive ground surface heat and, afterward, produce root sprouts (known as suckers) to begin a new, young aspen stand. Occasionally, mature aspen can produce wind borne seed to germinate new seedlings in post-fire bare soil. A single fire event or treatment can be a means to replace old trees with young aspen regeneration, provided all other conditions support the long-term survival of the new trees. Once successfully established, young and immature aspen clones benefit from a lack of fire until they reach maturity and are ready to repeat the renewal process.

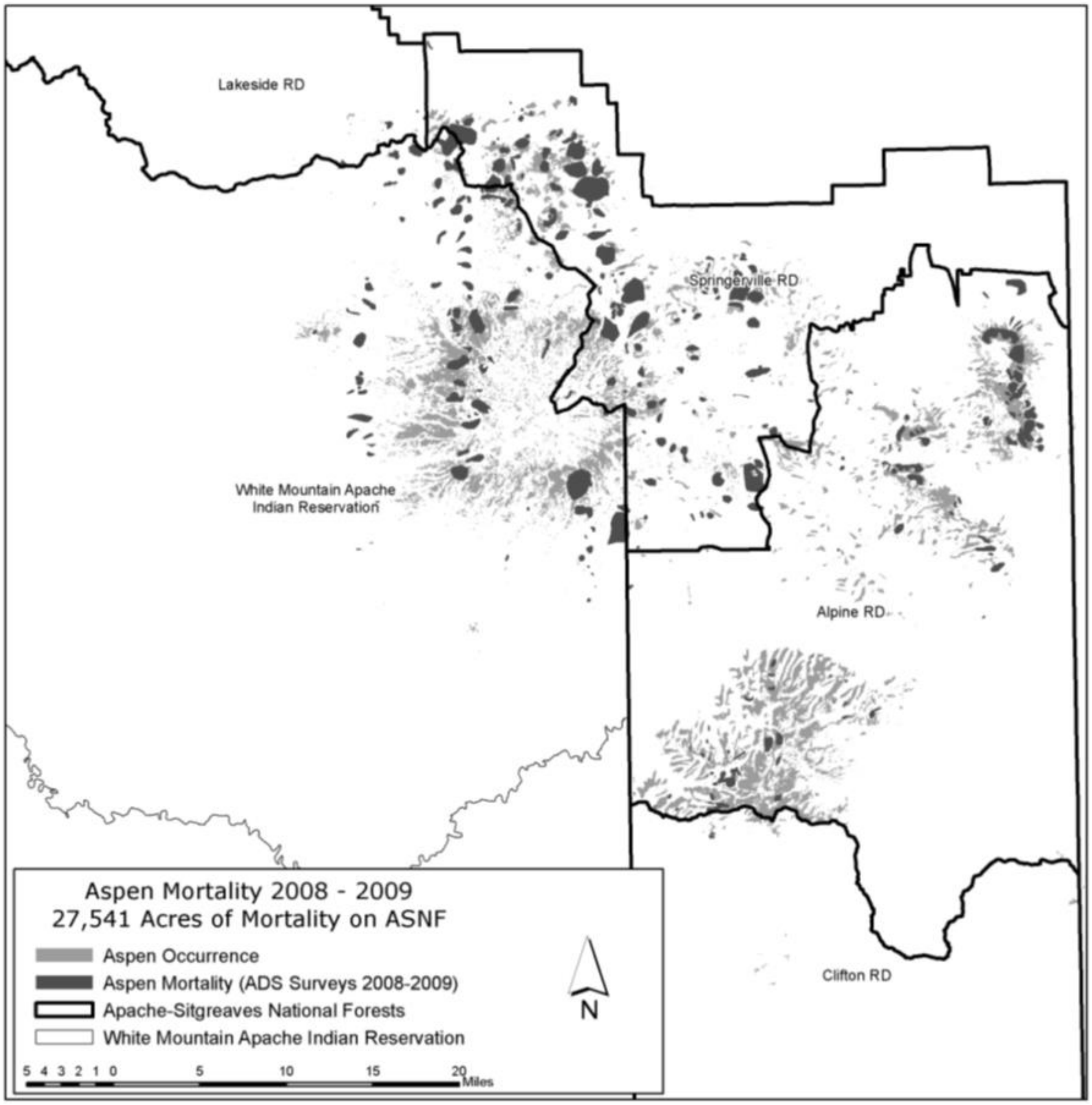

Figure 48. Map of forestwide aspen mortality in east-central Arizona 2008-2009 compiled from annual Forest Service aerial detection surveys

Persistent Diseases

Persistent pathogens (diseases like dwarf mistletoes, root/butt/stem decay fungi, and white pine blister rust) often cause substantial tree stress and growth losses over time. They diminish the mature trees' ability to produce viable seed. They also threaten the ability of young trees to successfully reach maturity. They intensify and/or spread infection beyond desired levels under the following conditions: excessively high forest densities, decline in site quality during drought; uniformity of host tree species; multistoried or uneven-aged stand structure uninterrupted across large acreages; host species encroachment into offsite vegetation types, including grassland and riparian PNVTs.

Dwarf mistletoe abundance was likely lower historically based on the present understanding of mistletoe ecology, increases in host abundance and canopy continuity over the past 150 years, and decreases in fire frequency. Table 51 shows known information about major disease infections on the Apache-Sitgreaves NFs by ranger district. See the “Forest Health Specialist Report” (Forest Service, 2014h) for data sources.

Table 51. Estimated percent of tree species infected with major diseases by ranger district[a]

Major Diseases		Black Mesa	Lakeside	Springerville[b]	Alpine[b]	Clifton[c]	Estimated Forestwide Average
Dwarf Mistletoe by Tree Host Species	Ponderosa Pine	54–61%	39%	67%	51%	NA	52%
	Douglas-fir	Present	NA	Present	Present	NA	50%
	Spruce-Fir	NA	NA	Present	Present	NA	60%
	SW White Pine	Present	NA	Present, possibly 20–30+%	Present, possibly 30+%	NA	Percent unknown
White Pine Known Centers	Blister Rust Infection	Surveys in progress	Present, more surveys in progress	Present, more surveys in progress	Present, more surveys in progress	Surveys in progress	Percent unknown
Root/Butt/Stem Fungi	Decay Infections	Present	Present	Present	Present	Present	Percent unknown[d]

[a] NA = detailed information not available or not applicable. Air detection surveys are not designed to inventory or monitor these diseases. Ground visits, permanent monitoring plots, and reported district observations are used instead.

[b] Data represent conditions prior to the 2011 Wallow Fire. Post-fire changed conditions have not been assessed.

[c] Persistent pathogenic disease levels are not well documented for the Clifton Ranger District due to a lack of road access for ground surveys and limited commercially suitable timber acres. This category is not easily mapped from air detection surveys.

[d] Levels of root/butt/stem disease infections are often missed during surveys because they are difficult to detect and mortality is often associated with bark beetles and/or dwarf mistletoe.Impacts on forest ecosystems may be underestimated.

Root rots can increase and spread to additional host trees when woody food sources are created and left onsite in the form of stumps and dead trees. Fires which do not create intense heat below the soil surface generally do not kill root diseases. Root diseases are a problem when they persist in developed recreation sites and other areas of human use because of hazard trees and continuing loss of desired tree cover. This persistent problem makes it more critical for comprehensive vegetation management plans to be completed under site-specific (project-level) NEPA analysis.

Recent Arrivals of Invasive or New Pests

Establishment of new invasive insects and pathogens is a growing threat. Recent arrivals of several nonnative pest species are of particular concern because natural resistance and control organisms may not exist or they are currently unknown in these ecosystems. White pine blister rust, an invasive disease, now infects Southwestern white pine. Numerous areas within the

Apache-Sitgreaves NFs provide suitable conditions for it to persist and spread because the prevalence of its required alternate host, *Ribes* (gooseberry and currant) bushes. *Ribes* bushes are common across the widespread area where white pines occur. This disease frequently attacks host trees in very wet drainage bottoms near permanent waters. Some infected trees and nearby *Ribes* bushes were killed by the Wallow Fire. Spruce aphid, a nonnative insect, now infests Engelmann spruce and, to a lesser extent, Colorado blue spruce (Lynch, 2004).

Several new insect and disease issues are likely to develop with native insects and diseases. If predicted warmer, drier climate trends continue, some insect and disease agents may become more prevalent and impact larger areas. Some localities may become more suitable for additional damaging insect and pathogen species. Insects and pathogens may expand their range into new territory or exhibit enhanced population dynamics through factors such as increased growth rates or increased survival. Previously innocuous native insects and diseases that become serious problems are known as emerging pests. Recent examples of emerging pests are loopers known as Janet’s looper and mountain girdle. These previously innocuous defoliators have severely damaged spruce-fir and mixed conifer forests across east-central Arizona. Prior to these events, Janet’s looper was known only from its taxonomic description, and neither looper had been recorded as causing damage in the Southwest. These outbreaks may be associated with warm climate trends or altered forest character. Janet’s looper is well distributed throughout the Southwest and California, including northern Arizona, so an outbreak is quite possible. Outbreaks by other previously innocuous species are also possible in northern and east-central Arizona.

Mountain pine beetle was not previously known to occur locally until its discovery above the Mogollon Rim on the Alpine Ranger District in 2008. It was first documented in association with fresh attacks on several Southwestern white pines that had survived the 2007 Chitty Fire (McMillin and Fitzgibbon, 2008; McMillin, 2009). The southern pine beetle, with the Mexican pine beetle, damaged almost 12,000 acres of Chihuahuan and Apache pine in the Chiricahua Mountains of southern Arizona in 2000. This was the first recorded southern pine beetle outbreak in Arizona. Southern pine beetle is part of the complex of pine bark beetles now present in north-central Arizona. Chihuahuan pine is regenerating naturally and successfully on harsh sites deforested by the 2002 Rodeo-Chediski Fire. The roles of southern and mountain pine beetles in future outbreaks are not clear.

Future Trends

Prevalent pest problems are expected to change as forest structure, species composition, and environmental conditions change. These changes may occur naturally and/or as a result of treatments. Many insects and diseases attack specific tree species and sizes or particular parts of trees. If small diameter ponderosa pine continues to be abundant, especially in dense stands, *Ips* outbreaks would continue. If shade-tolerant, fire-intolerant tree species continue to proliferate, so would their pests (e.g., fir engraver, western spruce budworm, root disease). Tip moth damage could worsen if warming temperature regimes occur.

Mortality would be elevated during droughts, perhaps dramatically. Based on observations of the recent severe drought, ponderosa pine and piñon mortality during future drought episodes should be greatest at middle to low elevations, in areas of poor site quality (e.g., shallow soils, southern aspects), and in high density stands. In recent outbreaks, mortality on some of the high risk sites approached 100 percent; therefore, those sites cannot experience the same severity of mortality until tree densities increase to pre-drought levels. During non-drought periods, ponderosa pine and piñon mortality should be higher in stands with high stand density indices and greater dwarf mistletoe infection.

If ponderosa pine forests continue to be dominated by smaller diameter size classes, *Ips* species would probably continue to be more significant than *Dendroctonus* species. This could be the case on new acres of pine sapling states resulting from wildfires. Conversely, where recent fuel reduction cuts, large tree retention strategies, aging stands, and proposed burns reduce smaller size classes and shift more of the average forest size to larger diameter classes, *Dendroctonus* beetle species would be favored.

If trends continue toward warmer climate and increasing fire damage, tree stress would also intensify. Tip moth and shoot borer damage may also increase, particularly in large post-fire tree planting projects. Production of fewer cone crops with viable seed is possible, as are more insect attacks to cones and seed. These could cause indirect problems for reforestation potential and wildlife food supply.

All aspen roots depend on plentiful green leaves above ground to produce good food supply for storage as root reserves. Newly formed aspen suckers depend on the parent root for nutrients and water (DeByle and Winokur, 1985). When mature aspen trees are replaced by suckers or new seedlings, the root system becomes most vulnerable to mortality by ungulate browsing and other defoliators. An increasing trend of widespread intense sucker browsing by ungulates has been well documented as killing persistent aspen root systems in less than 3 years after fire or aspen regeneration cutting (Fairweather, 2008; Shepperd and Fairweather, 1994; Rolf, 2001).

Aspen are known to readily resprout across the Apache-Sitgreaves NFs, both without and with disturbance (e.g., fire, tree cutting). Aspen regenerated prolifically after the 1951 Escudilla Fire and persisted onsite, growing into larger trees until 2011. However, the trend in survival of aspen suckers has been limited across the Apache-Sitgreaves NFs in the later portion of the 20th century, as evidenced by a widespread lack of the sprout/sapling and small tree sizes (generally less than 8 inches in diameter) outside of the Wallow Fire burned area. Informal monitoring across the Apache-Sitgreaves NFs over the last 15 years has found substantial ungulate browsing of aspen suckers and barking (teething) of aspen trees' photosynthetic bark during winter and spring, when herbaceous forage is unavailable or in a dormant (non-nutritious) state. This occurs when livestock are not on high elevation aspen and conifer forest sites. Given reduced snowfall over the last two decades, wild ungulates such as elk and deer, have remained on these high elevation sites during winter and spring for many of the last 20 years.

Across the Apache-Sitgreaves and other northern Arizona forests, where ungulates are fenced from aspen or where aspen occurs in very steep or rocky areas, its regeneration is persisting and thriving (Beschta and Ripple, 2010; Rolf, 2001; Shepperd and Fairweather, 1994; Rogers, 2008, 2009, 2011; Stritar et al., 2010). One factor for aspen decline may be that the primary wild ungulate on the Apache-Sitgreaves NFs today, Rocky Mountain elk, occurs in numbers far greater than the elk once native to the southwestern U.S., Merriam's elk, which became extinct by the first half of the 20th century (Thomas and Toweill, 1982).

Sudden aspen decline (SAD) has become a prevalent trend across the Southwest, including on the Apache-Sitgreaves NFs. This phenomenon includes aspen trees dying above ground as well as mortality occurring below the ground in the clonal root system (Rogers, 2008, 2009, and 2011). Documented observations on the Apache-Sitgreaves NFs following wildfires and prescribed fire include intensive sucker browsing, sapling girdling and toppling, and mature tree girdling (Rogers, 2011); residual aspen stands needing to be protected from further damage from slash pile and prescribed fire since excessive browsing by ungulates, particularly elk, is limiting successful regeneration of aspen (Fairweather, 2008); and preexisting clonal roots that were in decline before a wildfire not producing any suckers after the fire. Thus, aspen decline may be contributing to the inability of vulnerable clones to recover from fire.

This decline in clonal root system vigor is expected to continue as conifers on unburned acres continue to dominate aspen clones and weaken them by outcompeting for limited soil moisture in a drying climate; insects, diseases, and localized weather extremes (like unseasonable frost events) cause damage; lack of characteristic fire and/or occurrence of uncharacteristic fire continue; and elk browsing and bark gnawing damage persist on the majority of acres accessible to these ungulates (Rogers, 2008; Beschta and Ripple, 2010).

Dwarf mistletoe populations would continue to spread and intensify in ponderosa pine and Douglas-fir, further affecting stand character, forest character, and bark beetle vulnerability. Increases in dwarf mistletoe infection would occur where understory trees are exposed to infected overstory trees. Decreases in infection levels would occur in areas exposed to fire, which tends to burn the lower, usually more heavily infected limbs.

Invasive species and emerging pests would continue to present problems, and additional species would establish and become problematic. White pine blister rust would continue to expand into uninfected stands with top-kill, branch dieback, and mortality of larger Southwestern white pine on high hazard sites. Continued spruce aphid outbreaks would lead to diminished representation of Engelmann spruce.

Environmental Consequences of Alternatives

Not all conditions that influence insects and diseases can be controlled by treatment actions. Even with uncertainty regarding future climate and insect and pathogen activity, general management recommendations for reducing susceptibility and vulnerability to insects and diseases remain the same. These recommendations are to improve tree vigor and promote forest health by maintaining natural species, size, age class distributions, and stocking densities. Proposed treatments are intended to restore forest health by incorporating these general management recommendations.

Under **all alternatives**, thinning and wildland fire treatments combined would not be implemented on enough acres annually in the first 15 years to improve forest health trends forestwide. Only an average of 1.7 percent of the ponderosa pine, dry mixed conifer, wet mixed conifer, and spruce-fir PNVTs acres would be treated annually by **alternative A**, while **alternative B** would treat an annual average of 2.2 percent of each forested PNVT, **alternative C** would treat 3.3 percent of each, and **alternative D** would treat 3.2 percent annually of each forested PNVT. At year 15, a total average of about 24 percent of each forested PNVT would be treated by **alternative A**, roughly 33 percent treated by **alternative B**, about 49 percent by **alternative C**, and approximately 47 percent by **alternative D**.

In the piñon-juniper woodland PNVT, total thinning and wildland fire treatments would average from 0.5 percent annually in **alternative A** (under 8 percent total by year 15), to 1.1 percent annually in **alternative B** (under 17 percent by year 15), 1.4 percent annually in **alternative C** (about 21 percent by year 15), and 2 percent annually in **alternative D** (about 30 percent by year 15).

All remaining forest and piñon-juniper acreages would be left untreated each year, with generally about a third of each of these PNVTs benefitting from treatments by year 15, **regardless of the alternative**. Thus, nature would continue to manage more acres than humans could in this planning period.

Future Trends for Treated Acres

The following discussions pertain to factors that can be influenced by treatment actions and resulting consequences.

Bark Beetles

Risk of tree mortality due to bark beetles is most highly associated with four forest and woodland conditions that can be controlled by management activities: (1) high stand/forest density causing reduced vigor from intense tree competition; (2) activity created slash and/or windthrown trees left untreated onsite; (3) high dwarf mistletoe infections; and (4) trees stressed by fire damage (Parker et al., 2006; Fettig et al., 2007; Breece et al., 2008; Kenaley et al., 2008; Youngblood et al., 2009). Reduced dwarf mistletoe infection also reduces tree susceptibility to bark beetles.

High stand densities are correlated with higher beetle activity. Generally, a change from higher density to lower density would reduce tree competition and improve tree resistance to bark beetle attack. Threshold basal areas are used in determining bark beetle risk rating, along with amount of host tree species, and bole diameters most used by certain beetle species (McMillin and Boehning, 2010). For beetles in dry/warm forested PNVTs like ponderosa pine and dry mixed conifer, the basal area thresholds are lower than for the cold/moist forested PNVTs like wet mixed conifer and spruce-fir, because of differences in tree species shade tolerance.

The Southwestern Regional Office used regional and local forest inventory analysis plot data in the Forest Vegetation Simulator model to compute many biometric variables (e.g., basal area, number of canopy stories) for vegetation transition states in each forested PNVT (see Forest Service, 2014h and Weisz et al., 2012). When the percentage of each vegetation structural state across the landscape is estimated by the Vegetation Dynamics Development Tool (VDDT) model for each alternative at a point in time, such as year 15, the percentages of resulting basal area ranges can be tabulated. Using this approach, the following comparisons are made in table 52.

Table 52. Percent of forested PNVT by bark beetle risk and alternative at the end of the planning period (year 15) compared to existing conditions

Forested PNVT	Beetle Risk Rating[a]	Existing Percent[b]	Year 15 Alt. A	Year 15 Alt. B	Year 15 Alt. C	Year 15 Alt. D
Ponderosa Pine[c]	Low	26	20	21	23	19
	Moderate	20	28	28	32	25
	High	51	45	43	37	48
Dry Mixed Conifer[c]	Low	36	15	16	17	18
	Moderate	2	9	10	11	6
	High	61	56	44	55	56
Wet Mixed Conifer[d]	Low	36	5	5	6	7
	Moderate	10	14	9	9	10
	High	14	21	24	22	26
Spruce-Fir[d]	Low	34	5	10	10	11
	Moderate	0	3	10	10	9
	High	6	18	15	16	15

[a] The risk rating excludes states which are least utilized by conifer bark beetles. In the ponderosa pine and mixed conifer PNVTs, the following states are excluded: seedling/sapling states B and F (<5″ diameter). In the wet mixed conifer and spruce-fir PNVTs, the following states are excluded: the all size aspen state B and seedling/sapling/small states C, G, L, and P (<10″ diameter).

[b] Percentages do not add up to 100 due to rounding differences in VDDT model results and exclusion of model states little used by bark beetles.

[c] Risk rating based on basal area: low (<80), moderate (80–120), and high (>120)

[d] Risk rating based on basal area: low (<100), moderate (100–150), and high (>150)

As shown in the above table, **all alternatives** would reduce the amount of high risk acres in the ponderosa pine PNVT, with **alternative C** improving the most, followed by **alternatives B, A, and D**, respectively. Likewise, **all alternatives** would reduce the amount of high risk acres in the dry mixed conifer PNVT, with **alternative B** showing the most improvement, followed by **alternatives C, and then A and D**, respectively. **Alternative D** would consistently retain higher density of larger diameter trees on mechanically-treated acres because of a 16-inch diameter upper cutting limit (although the entire treatment includes more prescribed fire on other acres so that the modeled state transitions disguise this).

In the wet mixed conifer and spruce-fir PNVTs, **all alternatives** would increase the beetle risk with higher conifer densities dominated by trees 10 inches in diameter and larger, according to vegetation structural state transitions from the treatments modeled. This may be related to the higher densities of larger trees retained in modeling intended for legal compliance with the Mexican spotted owl recovery plan for existing protected habitat and target replacement habitat across the landscape.

Based on treatment rates and amount of wildland fire used, **alternative C** would have the least bark beetle risk in the short term (next 15 years and until all acres have received their first entry) followed by **alternatives B, D, and A**, respectively. **Alternative C** could reduce risk the most because it would create the highest amount of open forest/woodland using mechanical treatments without using as much wildland fire as the other alternatives. **Alternatives B and D** would also convert many acres to open density, but would use more wildland fire (especially moderate and/or high severity fire during the planning period) than **alternative C**. **Alternative D** would use the most wildland fire, thereby increasing tree stress and bark beetle susceptibility. **Alternative A** would treat the least acres and use the least wildland fire treatments.

The **action alternatives** include direction for prompt and appropriate treatment of tree cutting created slash and prevention of accelerated windthrow where dense stands are thinned to open the canopy. **Alternative A** provides some direction to prevent bark beetle outbreaks, but lacks direction on prevention of accelerated windthrow caused by overcutting.

Acres treated mechanically pose less threat than acres treated by wildland fire because thinning operations should not harm residual trees left onsite and slash would be treated afterward. Wildland fire stresses residual trees left onsite and the resulting tree mortality can become bark beetle brood material in 1 to 2 years, before it can be salvaged (Youngblood et al., 2009). **Alternative D** is expected to create and leave the most snags and untreated windthrow onsite as beetle brood material because it employs the most moderate and/or high severity fire while deemphasizing mechanized treatments. **Alternatives C, B, and A**, in order, could create fewer snags and prevent or salvage more windthrow to reduce risk of activity created bark beetle outbreaks.

Alternative D would preclude appropriate control of dwarf mistletoe by restricting cutting to trees under 16 inches in diameter, thereby leaving heavy infection where it occurs in large, stressed trees more susceptible to bark beetles. **Alternatives A and B** would also leave more infected trees to attract bark beetles than **alternative C**, but less than **alternative D**.

Defoliators

The risk of tree mortality by defoliators is associated with two forest conditions that can be controlled by management activities: (1) high stand/forest density that reduces tree vigor because of intense tree competition and (2) continuous multistoried canopies that allow defoliators free access to the most tree foliage food source at all canopy levels (Lynch et al., 2010; Hanavan and Boehning, 2010). Defoliators can use host trees of all sizes, especially when in very close proximity to many other host species trees, both horizontally and vertically. This means that large contiguous acreages of high density (closed canopy) and multistoried (i.e., uneven-aged) states are at greatest risk of defoliator outbreaks.

The percent of each forested PNVT in closed canopy, single-storied or multistoried structure as a result of proposed treatments in each alternative is displayed in table 53 below. This table uses the same methodology as table 52 above.

Table 53. Percent of forested PNVTs by number of closed canopy levels and alternative at the end of the planning period (year 15) compared to existing conditions

Forested PNVT	Canopy Level Class[a]	Existing Percent[b]	Year 15 Alt. A	Year 15 Alt. B	Year 15 Alt. C	Year 15 Alt. D
Ponderosa Pine	Single-storied	17	19	16	14	23
	Multistoried	55	43	44	40	39
Dry Mixed Conifer	Single-storied	17	13	12	12	18
	Multistoried	45	61	60	61	58
Wet Mixed Conifer	Single-storied	2	2	2	2	2
	Multistoried	50	66	67	67	68
Spruce-Fir	Single-storied	48	44	36	34	34
	Multistoried	17	39	38	38	37

[a] In the ponderosa pine and dry mixed conifer PNVTs, all closed canopy states (F, G, H, I, L, M) are included. In the wet mixed conifer and spruce-fir states, all closed canopy states (B, C, D, E, F, L, M, N, O) are included.

[b] Percentages do not add up to 100 due to rounding differences in VDDT model results and exclusion of model states little used by defoliators.

Ponderosa pine is the only PNVT where **all alternative**s would reduce the amount of closed multistoried canopy acres. **Alternatives D and C** would create the least closed multistoried forest structure, with at least a 3 percent advantage over **alternatives A and B**. In both mixed conifer and in spruce-fir PNVTs, where defoliator outbreaks are presently the highest concern, **all alternatives** would increase the amount of closed multiple-storied canopy structure, partly consistent with the desired conditions for more uneven-aged forest. Defoliator risk would remain high, with no alternative causing the least risk because all rank within 1 to 2 percent of each other.

Acres impacted by conifer-defoliating insects would be reduced as shade tolerant tree species like white fir and spruce are removed from the dry mixed conifer PNVT. Prescribed cutting selection to reduce offsite shade tolerant tree species would reduce forest susceptibility to defoliator insects to a greater degree than wildland fire treatments. **Alternative C** would have the greatest ability to remove offsite host trees, followed by **alternatives B, A, and D**, respectively. **Alternative D** would rank lowest because it would restrict cutting to trees less than 16 inches in diameter, thereby leaving seed cone bearing size, shade tolerant, and offsite tree species to perpetuate as an understory food source (Triepke et al., 2011).

As more acres of tree planting (see the “Forest Products” section) occurs after wildfires and/or substantial bark beetle outbreaks, the risk would increase for pine tip moth and similar foliar/bud/shoot insects to easily attack numerous seedlings. **Alternatives C, B, A, and D**, respectively, would rank from highest to lowest risk, ranked by fastest to slowest proposed planting rates. This risk could be mitigated for **all alternatives** at the project-level by designing plantations which are not continuously large areas of uniformly spaced trees of the same species.

Aspen Decline and Mortality

Risk of aspen mortality can be reduced by (1) removing conifers to reduce competition with aspen for water and sunlight and thereby improving clone health, restoring root carbohydrate reserves, and extending the lifespan of above ground trees; (2) protecting above ground trees from serious damage by fire, ungulates, and mechanized equipment (Debyle and Winokur, 1985; Fairweather, 2008; Shepperd and Fairweather, 1994; Rolf, 2001; Burns and Honkala, 1990); and (3) protecting below ground shallow lateral root systems that produce suckers from severe heat.

Given the large existing acreages of aspen damage, mortality, and decline, the risk of long-term aspen loss would be least in alternatives which provide opportunities for aspen roots to remain healthy. Reducing conifer competition and minimizing return fire to acres already burned would be most advantageous for long-term aspen tree and root maintenance (Fairweather, 2008; Debyle and Winokur, 1985). Based on differences in cutting methods emphasized, the alternatives most able to reduce conifer competition that is overtopping and shading out aspen would be **alternative C** followed by **B**, because these do not utilize a 16-inch diameter cutting limit (cap). **Alternatives A and D** would follow based on their respective use of that diameter cap[26.] Moreover, under **all alternatives**, all mixed conifer and spruce-fir sites managed in closed canopy, high conifer density condition would not be successful in maintaining or regenerating the aspen tree component on those acres.

Alternative A, with the least return of fire at any severity level, would maintain the most young and immature aspen above ground, followed by **C, B,** and then **D**. Where aspen are protected from ungulate damage this order may be reversed. Where mature/overmature aspen acreages need renewal, the **action alternatives** focus on using wildland fire to accomplish this first restoration step in the short term. Immediate follow-up steps to protect new aspen regeneration would help ensure long-term aspen recruitment.

Remaining aspen already in decline (perhaps as much as 35 percent of mature aspen acres, per surveys reported in Lynch et al., 2010) intentionally treated with moderate and/or high severity fire in the next 15 years may not recover in the long term if weakened root systems are unable to produce enough suckers or withstand repetitive ungulate browsing. In this case, **alternative D** would pose the greatest threat to aspen sustainability based on the amounts of moderate and/or high severity wildland fire treatments proposed annually, followed by **alternatives B, C, and A**.

The **action alternatives** provide guidance for aspen including desired conditions, an objective, management approach, and guidelines (e.g., discouraging new surface water developments in close proximity to aspen stands) that are improvements over the aspen direction in **alternative A**. One guideline could help reduce ungulate browsing pressure on aspen. These alternatives also provide other guidance for aspen which could achieve results comparable to the guidance in **alternative A**. The **action alternatives** recommend the Corduroy Research Natural Area (3,350 acres) as a study area to test various treatment methods for aspen protection, maintenance and restoration, and study of elk impacts in the absence of livestock. This could add to the knowledge base for managing aspen. **Alternative A** does not recommend this research natural area and would not provide additional information to help manage aspen.

[26] Alternative A (1987 plan) does not specify a 16-inch diameter cap. However, this diameter cap has been used as a treatment in recent and current vegetation management.

For long-term consequences to aspen from implementing the alternatives, see the VDDT model results summarized in the “Vegetation” section.

Persistent Diseases

Dwarf mistletoes and root/butt/stem decay diseases would persist under **all alternatives**. The risk of spread to more trees or acres for both types of pathogens is most highly associated with (1) the absence of alternate non-host tree species within and around infection centers and (2) the absence of large canopy gaps/openings in the forest (Conklin and Fairweather, 2010; Hagle, 2004).

Due to the less predictable nature of fire (including prescribed fire, especially at moderate and high-burn severity proposed during the planning period) those alternatives which employ more tree cutting may have more control in selecting the right mix of non-host tree species and/or spacing arrangement to prevent further disease spread. **Alternative C**, followed by **alternatives B, A, and then D**, respectively, would have the highest potential to minimize the spread of persistent diseases.

The spread of dwarf mistletoe disease to more host trees would occur where understory trees are exposed to infected overstory trees. This condition would exist on all infected acres with a multistoried vertical structure. A**lternative D** would restrict all cuts to less than 16-inch diameter trees on all acres, which would leave all infected overstory trees that would spread infection to nearby understory trees. Based on current management trends, **alternative A** would continue to use diameter limit cuts (diameter caps) on some acres to a lesser extent, even though the 1987 plan provides the most direction to control dwarf mistletoe. **Alternatives B** and **C** do not include diameter caps; **alternative B** has some focus on treating mistletoe. **Alternative C** emphasizes aggressive sanitation and/or even-aged cuts for removal of infected overstory trees where needed to maintain the uninfected small and medium size classes underneath or nearby. In this case, short-term use of even-aged treatments designed to control dwarf mistletoe spread on moderately to severely infected acres would temporarily delay attainment of desired conditions, yet may be a necessary first step to ultimately achieve long-term sustainability.

The potential for dwarf mistletoe to intensify infection levels within the same host trees (causing growth loss and mortality) would be reduced by removal of lower limbs (which are often the most highly infected). Mechanized tree cutting activities rarely involve pruning lower limbs because it is time consuming and expensive. Prescribed fire has shown some promise at reducing tree infection levels by killing the lower limbs (Conklin and Geils, 2008). With this consideration, alternatives which treat the most acres with wildland fire, in combination with sanitation cuts that would remove the most infected trees of all sizes, could be most successful at overall control in this order: **alternative B,** followed by **alternatives C, A, and then D**.

Root diseases could increase nearly equally in **all alternatives** because cutting, as well as wildland fire, would be used to treat acres, leaving new stumps that could become a food source for these diseases. Low to moderate intensity wildland fire would do little to kill root diseases. However, root disease spread would be slowed by the presence of non-host trees. In this order, **alternatives C and B** would not be limited in the methods of cut that enable favoring alternative non-host tree species inside root disease infection centers, and **alternatives A and D** would have the least control for this purpose because of diameter limit cutting methods.

White pine blister rust is now a persistent pathogen on the Apache-Sitgreaves NFs. Its control depends on keeping as many healthy white pines as possible across the landscape to ensure an abundance of genetically diverse individuals and trees groups (Conklin et al., 2009). Because many local populations of Southwestern white pine were killed by the Wallow Fire before seed could be collected from them, genetic diversity has already been greatly reduced. Remaining genetic diversity might still provide a blister rust resistant seed source that could be used to replace lost trees where desired. The consequences of individual alternatives upon the rust's alternate *Ribes* host are not yet possible to predict. Alternatives that would use the most wildland fire and diameter limit cuts could indiscriminately remove critically important healthy white pines and leave unhealthy ones. **Alternative C**, followed by **alternatives B, A, and D**, respectively, would have the greatest tree selection control to leave the healthiest remaining white pines.

Susceptibility to Additional Invasive Pests

Forests and woodlands most in balance (least departed from historic reference conditions) with respect to horizontal and vertical structure, native vegetation species composition and genetic diversity, soil and watershed stability, and natural disturbance patterns should be the most vigorous and resilient to threats from new invasive species. The alternatives which would move the four forested PNVTs and the piñon-juniper PNVT closest to desired conditions in the next 15 years are expected to help minimize that threat. **Alternative C** would provide the most resilience to invasive pests, followed by **alternatives B, D, and A**, respectively.

Future Trends for Untreated Acres

Current and future insect and disease trends described earlier are expected to continue on the vast majority of acres left untreated each year and in each cutting cycle, until these acres are fully restored to the desired conditions. Current trends on undisturbed acres differ enough from historic trends that ecosystem processes are anticipated to be altered in those areas where the benefits of treatment are delayed from occurring as needed. Drought, warmer climate, and uncharacteristic vegetation densities have increased the forests' vulnerability to insects, especially bark beetles. Consequently, the potential for substantial insect outbreaks continues, but it is difficult to characterize the risks in a temporal framework of 10 to 20 years. There is more uncertainty regarding future insect outbreaks than the past record indicates. In the current period of ecological change, additional large-scale insect disturbances are expected, though the timing and intensity of those events cannot be predicted.

Other than the continued spread and intensification of dwarf mistletoe infestations, it is harder to predict pathogen response to climate change and altered forest composition and fire regimes than insect population responses. Additionally, the potential effects of invasive insect and pathogen species (e.g., spruce aphid, white pine blister rust) are uncertain. The effects of invasive plants on forest disturbance regimes, including insect and pathogen outbreaks, are also unknown.

Under each alternative, the insect and disease trends described are expected to continue and possibly increase in proportion to the acres left untreated each year and decade. As stated previously, average treatment rates for **alternatives A and B** would result in the least amount of acres restored annually. Therefore, the affected environment trends and uncertainties would be greatest under these two alternatives. **Alternatives C and D** would treat more acres annually and would result in lower insect and disease risks.

Based strictly on expected treatment rates and relative amounts of annual untreated acres, **alternative A** would have the highest potential for insect and disease outbreaks in the four forested PNVTs, followed by **alternatives B, D, and C** respectively. This same order would also represent risk in the piñon-juniper woodland PNVT, except the rankings for **alternatives D and C** would be reversed.

As more acres of natural conifer regeneration (see the “Forest Products” section) occur after wildfires and/or substantial bark beetle outbreaks, the risk would increase under **all alternatives** for pine tip moth and similar foliar/bud/shoot insects to easily attack numerous seedlings. Survival of young trees (less than 6 feet) could be jeopardized, especially during drought years.

Cumulative Environmental Consequences

The area boundary considered for this level of analysis is the White Mountains-San Francisco Peaks-Mogollon Rim Ecoregion Section and the seven subsections on which it occurs (see the “Vegetation” section for more information about this region). Insect-disease conditions on the adjacent Fort Apache Indian Reservation are included in the report by Lynch et.al (2010).

Insect outbreaks typically start in one or more places and spread in subsequent years to additional areas. Persistent diseases have the potential to spread to or from adjacent ownerships wherever the same host tree species are present.

Past forest and woodland management approaches (e.g., fire suppression, lack of thinning) created surpluses of trees that dominate untreated areas for years across the Apache-Sitgreaves NFs and adjacent lands. Recent past and present forest and woodland management actions on national forest, private, and State lands have been mostly focused on reducing immediate fire hazards, rather than restoration toward reference conditions. Insect and disease outbreak trends, similar to those on the Apache-Sitgreaves NFs and across the Southwest, may be found across the ecoregion.

Future forest/woodland management strategies across all other national forests within the ecoregion are expected to be similar to those proposed for the Apache-Sitgreaves NFs. Those forests are also revising their land management plans or intend to revise their plans in the near future. The other national forests and the Apache-Sitgreaves NFs would use similar desired conditions for the forested and woodland PNVTs, including uneven-aged silviculture and the return of fire and other natural disturbances to their natural roles. Similar conditions for insects and diseases could be expected to result. However, increased thinning slash and fire-killed trees from management actions on all adjacent ownerships could cumulatively increase risk of larger scale bark beetle outbreaks. Treatment timing and coordination, with proper slash management (DeGomez et al., 2008), would need to occur across ownerships to prevent bark beetle outbreak.

Due to multiple ongoing bark beetle and defoliator outbreaks, the current scale and extent of dead and dying trees on both ownerships of Mount Baldy (Fort Apache Indian Reservation and Apache-Sitgreaves NFs) predispose it to a large, stand-replacement wildfire event, particularly inside the wilderness. **None of the alternatives** would be able to prevent such an event, given that the spruce-fir PNVT dominating the area is an infrequent, high-intensity fire regime and Mount Baldy is due for such an event. Prevailing winds could easily push a wildfire from the Fort Apache side of the mountain onto the Forest Service. Such a fire would virtually eliminate all the insect and disease problems present, simply by removing nearly all host tree species across many acres. Widespread, even-aged forest conditions would result with subsequent artificial and/or natural reforestation expected to occur on both ownerships.

Alternative C would emphasize more thinning treatments in the dominant wet mixed conifer and spruce-fir PNVTs, outside the Mount Baldy Wilderness, than the **other alternatives**. This could break up the remaining continuous forest and fuel loadings to the extent that such a wildfire event may not affect the entire watershed in every direction simultaneously and, thus, threaten more national forest acres to the north and northeast that are not yet restored.

The first known occurrence of white pine blister rust in this ecoregion was on the Gila NF in New Mexico; the first known occurrences in Arizona were found on the Fort Apache Indian Reservation. Future discovery of trees potentially resistant to white pine blister rust could contribute to tree seed tree orchards for a long-term rust resistance reforestation program; the perpetuation of this ecologically vital tree species is urgently needed (Conklin et al., 2009). On the Fort Apache Indian Reservation, the Bureau of Indian Affairs is cutting every white pine tree with observed blister rust infection. There is a critical need to preserve the gene pool of the remaining local species population on the Apache-Sitgreaves NFs. The **action alternatives** contain direction to protect white pines for this purpose; while **alternative A** does not.

Fire

This section discusses the current role and management of wildland fire on the Apache-Sitgreaves NFs. It also examines how the plan alternatives address the risk of uncharacteristic wildfire and how they contribute to returning wildfire to a more natural role. This is done by comparing the existing fire regime condition class (FRCC) with the alternatives to determine the percent of the forests that would move toward desired conditions. It also compares how each alternative may contribute smoke, by comparing the amount of wildland fire that is planned in each alternative and how each alternative varies in its emphasis of treatments near the wildland-urban interface. Additional information can be found in the “Fire Specialist Report” (Forest Service, 2014f).

In the analysis for this resource, assumptions include the following:

- To meet plan objectives, acres to be treated would include a combination of planned (prescribed fire) and unplanned (wildfire) ignitions across all NFS lands.
- A set acreage would be burned each year. This number varies by alternative. The actual acres burned, when the plan is implemented, may fluctuate yearly due to natural ignitions, weather, and burning conditions.
- All wildfires would be analyzed at the time of ignition and documented in the Wildland Fire Decision Support System (WFDSS). Management response to a wildfire would be based on direction in the land management plan. All wildfires would receive a management response appropriate to conditions of the fire, fuels, weather, and topography to accomplish specific objectives for the area where wildland fire may occur.
- The response to wildfires is not discretionary and is considered an emergency action. Suppression responses would vary markedly in scale and duration, depending on the particular fire and conditions.
- Particulate emissions from prescribed fires would be modeled at the project level.
- For this analysis, each PNVT was given an overall FRCC classification. For example, there are some areas in the ponderosa pine forest which have recently been treated and

those stands may now be in FRCC 1 or 2; however, the majority of the ponderosa pine across the forests is highly departed and, thus, the entire PNVT is classified as FRCC 3. FRCC classification represents conditions after the 2011 Wallow Fire.

Affected Environment

National Fire Policy and Wildland-Urban Interface

Fire managers have been faced with increasing costs, urban development, and uncharacteristic fire behavior. Decades of government policy directed at extinguishing every fire on public lands have contributed to the disruption of natural fire processes. In response to these issues, there have been several changes in national fire policy over the past two decades.

The Federal Fire Policy was signed in 1995 and reviewed and updated in 2001. In June 2003, the Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy replaced this cohesive fire policy. The current Federal Fire Policy, Guidance for Implementation of Federal Wildland Fire Management Policy, was signed in February 2009. This latest update guides the philosophy, direction, and implementation of fire management planning, activities, and projects on Federal lands. The policy helps ensure consistency, coordination, and integration of wildland fire management programs and related activities throughout the Federal government. The intent of this framework is to solidify that the full range of strategic and tactical options are available and considered in the response to every wildland fire and are used to achieve objectives as described in land management plans and/or fire management plans.

On August 8, 2000, the President directed the Secretaries of the Department of Agriculture and Department of the Interior to prepare a report recommending how best to respond to that year's severe fires, reduce the impacts of those fires on rural communities, and ensure sufficient fire management resources in the future. On September 8, 2000, the President accepted their report, "Managing the Impacts of Wildfires on Communities and the Environment" (USDA and USDOI, 2000), which provided an overall framework for fire management and forest health programs (66 FR 751-777).

These recommendations initiated a number of policies including the National Fire Plan, the Healthy Forests Initiative (HFI), long-term stewardship contracting authority, and the Healthy Forests Restoration Act (HFRA). These policies led to the preparation of community wildfire protection plans (CWPPs) to define the wildland-urban interface (WUI) and to establish priorities for wildfire preparedness and hazardous fuels reduction work in these areas.

WUI is more complex and extensive than previously considered in the 1995 and 2001 Federal Fire Policy reviews. Fire management activities affecting WUI areas require closer coordination and more engagement between Federal, state, local and tribal land and fire managers to ensure firefighter and public safety and mitigate property loss from wildland fire.

The WUI exists where humans and infrastructure intermix with wildland fuels. There continues to be a significant growth in the communities surrounded by the Apache-Sitgreaves NFs, both in population and construction of summer homes. For example, it was estimated in 2004 that there were approximately 25,000 full-time residents and 80,000 seasonal residents (primarily summer) in the White Mountain communities (Forest Service, 2008b).

There are 12 communities within or adjacent to the forests which have been identified as "Urban Wildland Interface Communities within the Vicinity of Federal Lands That Are at High Risk from Wildfire" (66 FR 751-777). They include Alpine, Eagar, Forest Lakes, Greer, Heber-Overgaard, Hideaways, Linden, McNary, Nutrioso, Pinedale, Pinetop-Lakeside, and Show Low (see figure 49 below). Hazardous fuel reduction treatments on adjacent Federal lands around these communities are ongoing.

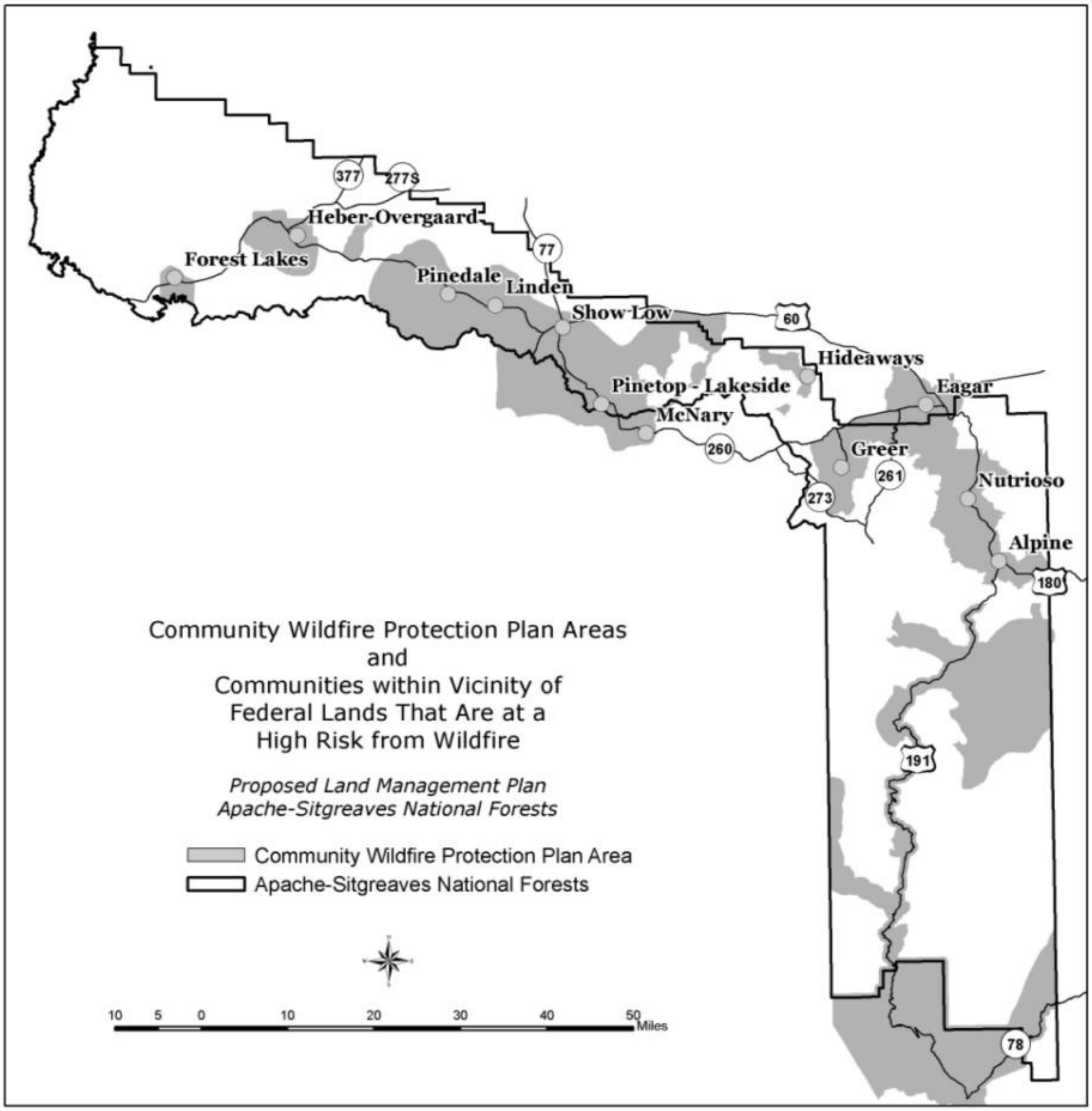

Figure 49. Map of communities within vicinity of Federal lands that are at a high risk from wildfire and areas currently covered by CWPPs

The forests have three CWPPs that cover over 895,000 acres of WUI on Federal, State, county, and private lands and include 36 communities within the boundaries. Approximately 612,000 acres on NFS lands are covered by the CWPPs (see figure 49). The CWPPs include "CWPP for At-Risk-Communities in Apache County," "CWPP for At-Risk-Communities in

Greenlee County," and the "Sitgreaves CWPP (includes Apache, Coconino, and Navajo Counties)" (Logan Simpson Design, Inc., 2004a, 2004b, and 2005). These plans identify and prioritize areas for treatment based upon input from the communities. Because the CWPPs did not cover all development that might be threatened by wildfire, the following WUI definition is also used when considering values to be protected:

> "Wildland-Urban Interface (WUI) - includes those areas of resident populations at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved." (R3 Supplement Forest Service Manual 5140.5)

Alternative A (1987 plan) does not address hazards associated with the WUI. However, since 2001, there has been a management emphasis to treat areas identified in the CWPPs and WUI.

Fire History and Behavior

At the time of Euro-American settlement, the Apache-Sitgreaves NFs, as well as other forests in northern Arizona, generally consisted of open stands of uneven-aged ponderosa pine with an extensive grass-forb understory. Frequent (every 2 to 17 years) low-intensity fires burning through small pine regeneration and other ground fuels, prevented forests from becoming the dense stands frequently found in northern Arizona today.

Fire scar samples from ponderosa pine trees in the White Mountains show an average return interval of 3 years with widespread fires occurring every 10 years (Forest Service, 2002). Grasslands on southern aspects had the greatest frequency; fires were fast moving and killed conifer seedlings encroaching from adjacent forested areas.

Fire frequency and severity have been altered from historic condition in most vegetation types. Historically, fires could burn until they were extinguished by precipitation, ran out of fuel, or reached a previously burned area. Fires could burn for months and cover thousands of acres (Swetnam and Betancourt, 1990; Swetnam and Baisan, 1996). Fire severity is an actual physical change in the vegetation, litter, or soils caused by fire. Post-fire effects are typically classified as low to high severity[27].

Table 54 displays historical frequency and severity of fires within PNVTs. The 2011 Wallow Fire is used as an example of how these vegetation types burned based on mapped burn soil severity classes. It also summarizes, in the last column, the observed effects from the Wallow Fire. For example, the dry mixed conifer PNVT, which would have historically burned every 10 to 22 years with low-severity fires, experienced a wide range of severities in the Wallow Fire. While dry mixed conifer within the Wallow Fire experienced predominately low-severity effect, almost 41 percent of the acres burned at moderate to high severity. In addition, the wet mixed conifer PNVT had approximately 50 percent of the acres burned in moderate to high severity. Historically, wet mixed conifer burned with a mixed fire severity with discontinuous patches of high severity.

[27] http://www.northernrockiesfire.org/history/fireis.htm

Table 54. Fire frequency and severity by PNVT[a] compared to the 2011 Wallow Fire burn severities

PNVT	Historic Fire		Wallow Fire Burn Acres Severity (Percent) within Perimeter				
	Fire Return Interval (years)	Fire Severity	High	Moderate	Low	Unburned	Wallow Fire Severity
Ponderosa Pine Forest	2 to 17	Low	11,809 (9.2)	22,734 (17.6)	79,821 (61.9)	14,488 (11.2)	Low-Mixed
Dry Mixed Conifer Forest	10 to 22	Low	19,412 (24.9)	12,253 (15.7)	31,462 (40.4)	14,813 (19)	Low-High
Wet Mixed Conifer Forest	35 to 50	Mixed	47,409 (35.3)	19,835 (14.8)	43,494 (32.4)	23,702 (17.6)	Low-High
Spruce-Fir Forest	150 to 400	High	3,874 (30.6)	2,462 (19.5)	3,897 (30.8)	2,423 (19.1)	Low-High
Madrean Pine-Oak Woodland	3 to 8	Low	1,246 (2.3)	4,767 (9.0)	20,396 (38.4)	26,679 (50.3)	Low
Piñon-Juniper Woodland	6 to 400	Low, Mixed, and High	583 (3.3)	2,225 (12.5)	5,587 (31.4)	9,389 (52.8)	Low
Interior Chaparral	20 to 100	High	357 (3.6)	2,426 (24.4)	3,266 (32.8)	3,900 (39.2)	Low-Mixed
Great Basin Grassland	10 to 30	Low	88 (1.3)	325 (4.9)	3,311 (50.3)	2,854 (43.4)	Low
Semi-desert Grassland	3 to 10	Low	35 (2.3)	251 (16.5)	606 (40.0)	624 (41.2)	Low
Montane/Subalpine Grasslands	2 to 400	Low	176 (0.5)	1,679 (4.6)	27,422 (75.3)	7,159 (19.6)	Low
Wetland/Cienega Riparian Areas	0 to 35	Low	441 (3.7)	759 (6.4)	7,406 (62.7)	3,212 (27.2)	Low
Cottonwood-Willow Riparian Forest	0 to 35	Low	72 (4.2)	176 (10.1)	731 (42.0)	759 (43.7)	Low-Mixed
Mixed Broadleaf Deciuous Riparian Forest	0 to 35	Low	0 (0.1)	27 (5.6)	212 (43.2)	251 (51.1)	Low
Montane Willow Riparian Forest	0 to 35	Low	196 (5.9)	424 (12.7)	1,674 (50.2)	1,041 (31.2)	Low-Mixed

[a] Forest Service, 2008e

Years of land management practices in the early 1900s (e.g., fire suppression, livestock grazing) have impacted the ability of fire to play its natural role in maintaining ecosystem health (Covington and Moore, 1994). Consequently, there are higher levels of woody vegetation (fuel loads) and less herbaceous cover than existed historically (Forest Service, 2008e). Altered fire regimes are now the norm in fire-adapted ecosystems in the Southwest and have resulted in uncharacteristic wildfires, which are increasingly larger and more severe. This has resulted in increased attention to the way land is managed in the Southwest (Swetnam and Betancourt, 1997).

On the Apache-Sitgreaves NFs, fire season is generally April 1 through October 15. Strong southwest winds and low humidity prevail from mid-April to mid-June, resulting in mainly wind driven fire behavior. Hot, dry, and unstable conditions usually occur from mid-June to early July. The potential for dry lightning is highest during this time period. The monsoon season, accompanied by higher humidity and rainfall potential, decreased wind, and reduced fire behavior, generally begins the first or second week in July and typically ends in the second or third week in September when dry and mild conditions return, leading to a period of increased fire behavior potential before the onset of winter conditions.

From 1997 to 2011, the majority of fires on the Apache-Sitgreaves NFs were caused by lightning, averaging 155 fire starts per year. The remaining fires were human caused, averaging 64 fire starts per year. Both human and lightning fires contribute to the total number of acres burned on the forests. Fires occurred every month of the year with the greatest number occurring from May to August and usually lasting less than 2 days.

Over a million acres burned on the Apache-Sitgreaves NFs between 1997 and 2011. About 80 percent were unplanned ignitions, while approximately 20 percent were planned ignitions. Approximately 40 percent of the acreage burned in the ponderosa pine PNVT. Fire sizes have been generally small with over 65 percent less than one quarter of an acre and 94 percent less than 10 acres (Fire Family Plus). The 2002 Rodeo-Chediski Fire burned 173,000 acres on the forests and the 2011 Wallow Fire burned 538,000 acres. Both of these fires were human caused.

Fire Regime Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but includes the influence of aboriginal burning (Agee, 1993; Brown, 1995). Coarse-scale definitions for natural fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). The five natural fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity of the fire on the dominant overstory vegetation. These five regimes include the following:

- **Fire regime I:** 0- to 35-year frequency and low (surface fires most common) to mixed severity (less than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime II:** 0- to 35-year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime III:** 35- to 100+-year frequency and mixed severity (less than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime IV:** 35- to 100+-year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime V:** 200+-year frequency and high (stand replacement) severity.

All fire regimes are represented across the forests (Landfire, 2011) as noted in table 55.

Table 55. Fire regimes by PNVTs on the Apache-Sitgreaves NFs

PNVT	Fire Regime
Ponderosa Pine Forest	I
Dry Mixed Conifer Forest	I
Wet Mixed Conifer Forest[a]	III
Spruce-Fir Forest	III, IV
Madrean Pine-Oak Woodland	I
Piñon-Juniper Woodland[b]	I, II, III, IV, V
Interior Chaparral	IV
Great Basin Grassland	I
Semi-desert Grassland	I, II
Montane/Subalpine Grassland	I, II
Cottonwood-Willow Riparian Forest[c]	I, III
Mixed Broadleaf Deciduous Riparian Forest[c]	I, III
Montane Willow Riparian Forest[c]	I, III
Wetland/Cienega Riparian Areas[c]	I, III

[a] Within wet mixed conifer, fire regime IV and V may occur; however, it is rare.

[b] Within piñon-juniper, fire regime I is found in piñon-juniper savanna; while II, III, IV, and V are found in piñon-juniper persistant woodland.

[c] Wetland/cienega riparian areas and mixed broadleaf deciduous, montane willow, and cottonwood-willow riparian forests' historic and current fire return intervals are strongly influenced by surrounding PNVTs and their fire regimes.

Fire regime condition class (FRCC) is a metric that quantifies how departed a system is from historical conditions in relation to fire, the role fire historically played in that system, and the vegetative structure (Hann and Bunnell, 2001; Hardy et al., 2001; Hann et al., 2004). The classification is based on a relative measure describing the degree of departure from the historical fire regime. FRCC is developed as a measure of the difference in structure between current and reference condition. This disparity has inferences about fire regime and changes to one (or more) of the following ecological components: vegetation characteristics (e.g., species composition, structural states, stand age, canopy closure, mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g., insect and disease mortality, grazing, drought).

There are three condition classes for each fire regime based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural fire regime (Hann and Bunnell, 2001; Hardy et al., 2001; Schmidt et al., 2002). Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside. The desired condition is to move toward or maintain vegetation conditions in FRCC 1.

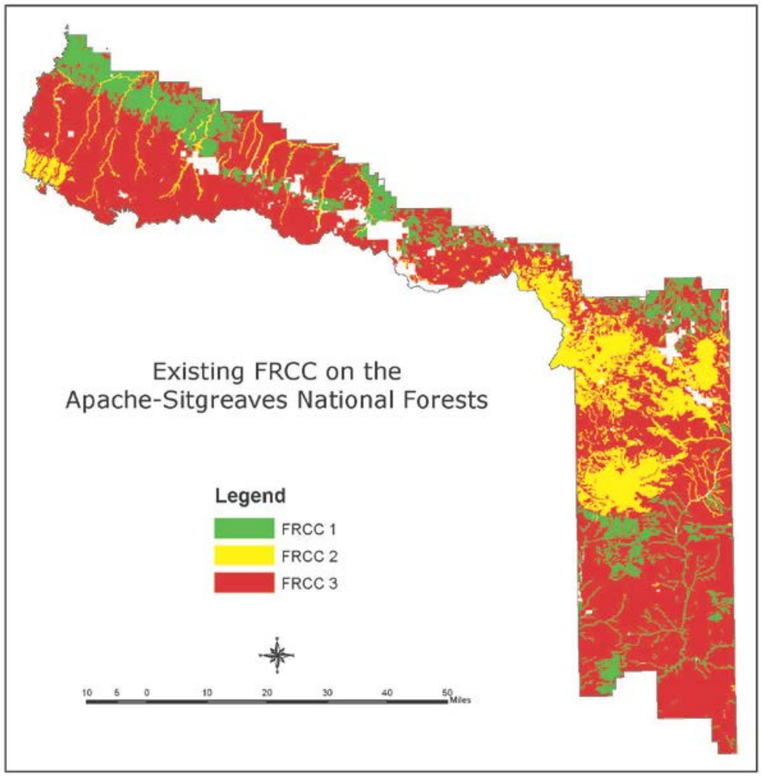

Figure 50. Map of existing fire regime condition classes on the Apache-Sitgreaves NFs based on PNVT departure

Vegetation in FRCC 1 is more resilient and resistant and less likely to lose key ecosystem components (e.g., native species, large trees, soil) after a disturbance. Fire behavior and other associated disturbances are similar to those that occurred prior to fire exclusion. For example, ponderosa pine in FRCC 1 would have a fire regime and vegetative structure similar to reference conditions where fires were low intensity and high frequency and vegetation consisted of open stands and clumps of trees.

Vegetation in FRCC 2 and 3 is moderately to highly altered and there is a risk of losing key ecosystem components. Fire behavior and other associated disturbances are moderately to highly departed from reference conditions.

For this analysis, FRCC 1 is represented by vegetation departure index 0 to 33, FRCC 2 is 34 to 66, and FRCC 3 is 67 to 100. For more information about vegetation condition and departure from desired conditions, see the “Vegetation” section. Approximately 86 percent of the Apache-Sitgreaves NFs are departed from reference conditions and are in FRCC 2 and 3 (figure 50 and table 56). Current overall FRCC by PNVT is displayed in table 57. Only 14 percent of the PNVTs are in FRCC 1.

Table 56. Existing forestwide FRCC on the Apache-Sitgreaves NFs

	FRCC 1	FRCC 2	FRCC 3	Total	
Acres	287,804	287,804	280,996	1,442,302	2,011,102[a]
Percent	14%	14%	14%	72%	100%

[a] Total excludes water, quarries, urban/agriculture lands.

Table 57. Current FRCC by PNVT

PNVT	FRCC
Ponderosa Pine Forest	3
Dry Mixed Conifer Forest	3
Wet Mixed Conifer Forest	2
Spruce-Fir Forest	2
Madrean Pine-Oak Woodland	3
Piñon-Juniper Woodland	1
Interior Chaparral	1
Great Basin Grassland	3
Semi-desert Grassland	3
Montane/Subalpine Grassland	2
Cottonwood-Willow Riparian Forest	2
Mixed Broadleaf Deciduous Riparian Forest	1
Montane Willow Riparian Forest	3
Wetland/Cienega Riparian Areas	2

Air Quality Related to Smoke

Periodic planned ignitions (prescribed burns) and unplanned ignitions (wildfires) are tools used to decrease fuel accumulation and to restore ecosystem processes. Wildfires and prescribed burns within the planning area may produce temporary, but large, amounts of smoke, particulates, carbon monoxide, and other ozone precursors.

Limits to smoke emissions from prescribed fires and wildfires are imposed by the Arizona Department of Environmental Quality (ADEQ). Smoke from wildfires is considered a natural event; fire managers work to influence smoke production by suppressing fires, checking or redirecting the growth of the fire, or through smoke reduction techniques, such as performing burns when climatic conditions are optimal.

Prescribed fires and wildfires have the potential to produce smoke that may impact air quality depending on the amount, extent, and duration. Wildfire events and associated poor air quality can last for weeks. For example, during June and July of 2002, when the Rodeo-Chediski Fire occurred, over 460,000 acres burned across multiple jurisdictions and affected air quality in the communities along the Mogollon Rim for weeks.

Particulate matter (PM) is the greatest concern because particulate emissions in smoke can affect both visibility and human health. Particulate matter is described as very fine solid particles suspended in smoke and is measured as a 24-hour average. PM_{10} particles are 10 microns or less in size; $PM_{2.5}$ particles are 2.5 microns or less in size. The amount of particles present in these size classes, especially $PM_{2.5}$, is important when considering the health effects of smoke. $PM_{2.5}$

particles can become lodged in the deepest part of the respiratory system and are difficult for the body to expel.

The Clean Air Act mandates that every state have a statewide implementation plan to regulate pollutants. Smoke is regulated with oversight and compliance by the State of Arizona. The Arizona State Implementation Plan, administered by the ADEQ, requires that Federal and State land management agencies submit annual registrations, prescribed fire burn plans, and prescribed burn requests in order to obtain authorization to burn.

Arizona is divided into 11 smoke management units (SMUs). The Apache-Sitgreaves NFs occurs within 3 units: Little Colorado River Airshed (SMU 3), Lower Salt River Airshed (SMU 6), and Upper Gila River Airshed (SMU 7). Special considerations to address smoke are required when a fire is in a nonattainment area for national ambient air quality standards[28] including ensuring compliance and conformity with State and tribal implementation plans. There are no nonattainment areas within SMUs 3 and 7; however, there is a nonattainment area in SMU 6 southwest of the forests around Payson, Arizona, and a southeastern portion of the forests falls within a sulfur dioxide (SO_2) maintenance plan area near Morenci. Disturbances, as described within this plan (e.g., vehicles traveling on unpaved roads, smoke from fires), may have an insignificant impact on air quality within the nonattainment area.

There is one Class I airshed on the forests, Mount Baldy Wilderness. Petrified Forest National Park is another Class I airshed directly north of the forests. Class I is an airshed classification which requires the highest level of protection under the Clean Air Act. Projects which may impact Class I airsheds must include efforts to minimize smoke impacts on visibility. See the “Air Quality” section of chapter 3 for more information on Class I airsheds and overall air quality.

Environmental Consequences of Alternatives

Wildland-Urban Interface

Alternative A (1987 plan) would not specifically address hazards associated with the WUI or prioritize treatments to address those hazards. Since 2001, however, there has been a management emphasis to treat areas identified in CWPPs and WUI.

Due to the threat of fire moving into or from developed areas, higher levels of management may be needed to restore fire-adapted ecosystems, including regular maintenance treatments. The **action alternatives** have a management area to address this threat. The Community-Forest Intermix Management Area consists of NFS lands within ½ mile of communities-at-risk. The Community-Forest Intermix Management Area accounts for approximately 10 percent of the NFS lands identified in the CWPPs. See appendix J for maps of the management areas.

All the **action alternatives** have land allocated to the Community-Forest Intermix Management Area where fuels reduction treatments and maintenance are emphasized. However, these alternatives differ in where overall forest treatments are prioritized for placement.

Alternative B would most emphasize treating lands identified in the CWPPs, including the Community-Forest Intermix Management Area. **Alternative C** would prioritize treatments just in

[28] The Clean Air Act requires the Environmental Protection Agency to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment.

the Community-Forest Intermix Management Area (versus the entire CWPP). **Alternative D** would not emphasize treating areas identified in the CWPPs because treatment emphasis is spread over all PNVTs across the forests.

Table 58. Comparison of alternatives and how much emphasis is placed on treating the hazards associated with the WUI

Least Emphasis	Less Emphasis	More Emphasis	Most Emphasis
Alternative A	Alternative D	Alternative C	Alternative B

As treatments occur within the WUI, the risk of uncharacteristic wildfire and the resulting threat to communities and ecosystems would be reduced and potential losses from such fires would be mitigated. Treatments within the WUI would help protect communities and protect the forests from fire that starts on private lands. These treatments would also benefit firefighter and public safety. Treatments aimed to protect natural resources from uncharacteristic wildfire could outweigh the short-term impacts to the landscapes during treatment. **Alternative B** would provide the greatest benefit followed by **alternatives C, D, and A** based on the alternative's emphasis.

Fire Regime Condition Class

Both mechanical and wildland fire treatments would be used to move vegetation toward desired conditions in **all alternatives**. These treatments are used to change the character of the vegetation (e.g., a dense forest with too many evenly spaced trees to an open forest with groups and clumps of trees) that would result in lower risk of uncharacteristic fire and a return of wildfire to a more natural role. The desired condition is to move toward or maintain vegetation conditions in FRCC 1. The treatment acreages vary by alternative, as shown in tables 59 and 60.

Table 59. The average annual acreage by treatment type, planned by alternative across all PNVTs

Treatment Type	Alt. A Acres	Alt. B Acres	Alt. C Acres	Alt. D Acres
Mechanical	12,182	19,591	23,997	15,954
Wildland Fire (Planned and Unplanned Ignitions)	6,844	28,930	12,857	48,927
Total	**19,026**	**48,521**	**36,854**	**64,881**

Table 60. Average acres treated by PNVT per year (percent of PNVT treated per year)

PNVT	Total NFS Acres	Alt. A Acres (Percent PNVT)	Alt. B Acres (Percent PNVT)	Alt. C Acres (Percent PNVT)	Alt. D Acres (Percent PNVT)
Ponderosa Pine Forest	602,206	10,269 (1.7%)	12,589 (2.1%)	18,955 (3.1%)	18,113 (3.0%)
Dry Mixed Conifer Forest	147,885	2,608 (1.8%)	3,247 (2.2%)	4,913 (3.3%)	4,761 (3.2%)
Wet Mixed Conifer Forest	177,995	3,097 (1.7%)	3,800 (2.1%)	5,748 (3.2%)	5,464 (3.1%)
Spruce-Fir Forest	17,667	208 (1.2%)	402 (2.3%)	605 (3.4%)	576 (3.3%)
Madrean Pine-Oak Woodland	394,927	1,063 (0.3%)	7,429 (1.9%)	3,125 (0.8%)	13,029 (3.3%)
Piñon-Juniper Woodland	222,166	1,213 (0.5%)	2,502 (1.1%)	3,008 (1.4%)	4,367 (2.0%)
Interior Chaparral	55,981	*	*	*	*
Great Basin Grassland	185,523	541 (0.0%)	15,202 (8.2%)	0 (0.0%)	15,121 (8.2%)
Semi-desert Grassland	106,952	27 (0.0%)	2,500 (2.3%)	0 (0.0%)	2,500 (2.3%)
Montane/Subalpine Grassland	51,559	*	500 (1.0%)	500 (1.0%)	500 (1.0%)
Cottonwood-Willow Riparian Forest	15,876	*	350 (0.7%)	*	450 (0.9%)
Mixed Broadleaf Deciduous Riparian Forest	9,657				
Montane Willow Riparian Forest	4,808				
Wetland/Cienega Riparian Areas	17,900				
Total	**2,011,102**	**19,026 (0.9%)**	**48,521 (2.4%)**	**36,854 (1.8%)**	**64,881 (3.2%)**

*No treatments planned. However, as opportunities arise wildfire may be used to allow fire to play a natural role.

Table 61 displays the forestwide FRCC outcome by alternative after 15 years of vegetative treatments at the average treatment objective levels. **Alternatives B and D** would result in the most acreage in FRCC 1 (24 percent) followed by **alternatives A and C** (14 percent).

Table 61. Forestwide FRCC outcome by alternative in acres and percent of the forests after 15 years of treatment

Alternative	FRCC 1	FRCC 2	FRCC 3	Total
A	287,804 (14%)	614,405 (31%)	1,108,893 (55%)	2,011,102 (100%)
B	473,327 (24%)	823,809 (41%)	713,966 (35%)	2,011,102 (100%)
C	287,804 (14%)	1,009,332 (51%)	713,966 (35%)	2,011,102 (100%)
D	473,327 (24%)	823,809 (41%)	713,966 (35%)	2,011,102 (100%)

Table 62 displays the FRCC trend from 15 to 50 years as noted by the downward, upward, or neutral arrows. In **all alternatives**, wildland fire and mechanical treatments (table 59) would be used to move vegetation conditions toward desired condition. The desired condition is to move toward or maintain vegetation conditions in FRCC 1. A downward trend (downward arrow) shows movement toward a lower FRCC.

Table 62. Comparison of alternatives showing FRCC outcomes by PNVT after 15 years and the trend from 15 to 50 years as represented by the arrows

PNVT	Current FRCC	Alt. A FRCC	Alt. B FRCC	Alt. C FRCC	Alt. D FRCC
Ponderosa Pine Forest	3	3↓	3↓	3↓	3↓
Dry Mixed Conifer Forest	3	2↓	2↓	2↓	2↓
Wet Mixed Conifer Forest	2	2↓	2↓	2↓	2↓
Spruce-Fir Forest	2	2↓	2↓	2↓	2↓
Madrean Pine-Oak Woodland	3	3↓	2↓	2↓	2↓
Piñon-Juniper Woodland	1	1↑	1↑	1↑	1↔
Interior Chaparral	1	1↔	1↔	1↔	1↔
Great Basin Grassland	3	2↑	1↑	2↑	1↓
Semi-desert Grassland	3	3↑	3↓	3↑	3↓
Montane/Subalpine Grassland	2	2↑	2↑	2↑	2↑
Cottonwood-Willow Riparian Forest	2	2↑	2↓	2↑	2↓
Mixed Broadleaf Deciduous Riparian Forest	1	1↑	1↓	1↑	1↓
Montane Willow Riparian Forest	3	3↑	3↓	3↑	3↓
Wetland/Cienega Riparian Areas	2	2↑	2↔	2↔	2↔

↑ Indicates trend toward a higher FRCC from 15 to 50 years.

↓ Indicates trend toward a lower FRCC from 15 to 50 years.

↔ Indicates a static trend in FRCC from 15 to 50 years.

Over the planning period of 15 years, the **action alternatives** would have the most (6) PNVTs at desired condition. **Alternative A** would have the least number (5) of PNVTs that meet desired conditions.

Between 15 and 50 years, **alternatives D and B** trends show that FRCC continues to move toward a lower FRCC or remain within FRCC 1 in the most PNVTs (12). **Alternatives C and A** show the least improvement at 50 years (8).

Under **all alternatives** there would be some improvement in FRCC by PNVTs (table 62). Changes in FRCC are directly related to the number of acres treated within a PNVT. For example, Great Basin grassland would be treated in **alternatives B and D** and would move from FRCC 3 to 1. In **alternatives A and C**, there would be less emphasis on treating Great Basin grassland; it would move to FRCC 2 but would trend back toward a higher FRCC.

As the FRCC is improved over the planning period, there should be movement toward a natural fire regime and a reduced risk of uncharacteristic wildfire. Vegetation would become more resistant and resilient and less likely to lose key ecosystem components after a disturbance. This would benefit firefighter and public safety. Additionally, treatments aimed to protect natural resources from uncharacteristic wildfire would outweigh the short-term impacts upon the landscapes during treatment.

As FRCC is improved over the planning period, fire would behave more similar to reference conditions. For example, ponderosa pine in FRCC 1 would have a fire regime and vegetative structure similar to reference conditions where fires were low intensity and high frequency. Vegetation consisting of open stands and clumps of trees would promote surface versus crown fire behavior.

Although this analysis examined overall FRCC by total PNVT, it is anticipated that as site-specific projects are conducted, there would be an improvements in FRCC for those treated acres. For example, the overall FRCC for ponderosa pine is 3, but includes areas which have been treated and are now rated at FRCC 1 and 2.

Fire disturbances may have short-term, adverse environmental consequences on some resources (e.g., smoke affecting communities, vegetation structure). Over the long term, however, these resources would benefit from fire disturbances that result in more sustainable and productive ecosystems and reduced risk of uncharacteristic wildfire.

Wildland fire is a management tool for altering vegetation; however, there could be some risks such as (1) prescribed fires could escape and become wildfires, (2) some fires may not get accomplished due to narrow burning windows and/or smoke management constraints, and (3) use or allowing of high and/or moderate intensity fire may result in more acres needing reforestation efforts (e.g., Wilkins, Durfee, and Wagon Draw wildland fires.)

Air Quality Related to Smoke

All alternatives include an average number of acres that would be treated by wildland fire each year with the expectation that desired conditions for air quality, including Class I airsheds, are met. Treatments with wildland fire include both prescribed fires and use of wildland fires. Table 60 displays the amount of acres treated by alternative.

Smoke production is an unavoidable part of planned ignitions (prescribed burns). However, strategies to limit smoke impacts are required in every prescribed fire plan. Because climatic and environmental conditions vary (e.g., ventilation, wind direction, mixing height), the number of acres burned on any given day would also vary. Climatic and environmental conditions each year may also affect the annual total number of acres treated. Projects are designed in a way to lessen the impacts produced by smoke emissions. The prescribed fire burn plan may include such strategies as burning with wind directions and other atmospheric conditions that allow smoke to adequately ventilate or be transported away from communities. The burn plan may also stipulate management practices which would mitigate smoke production. For example, managers can choose ignition sequences and patterns, avoid lighting heavy fuels, community notification, and use other management practices that would limit smoke production. ADEQ reviews daily burn requests and may limit the amount of acres burned daily to reduce smoke impacts.

Impacts on air quality from wildfires may be highly variable. Smoke management for wildfires includes notifying the ADEQ based on fire size and location, and assessing potential fire behavior and smoke. If smoke impacts occur, overall fire management strategies may be adjusted in order to mitigate smoke to sensitive individuals, communities, and visibility.

Problem or nuisance smoke is defined by the Environmental Protection Agency as the amount of smoke in the ambient air that interferes with a right or privilege common to members of the public, including the use or enjoyment of public or private resources. While no laws or regulations govern nuisance smoke, it effectively limits opportunities of land managers to use fire. Public outcry regarding nuisance smoke often occurs long before smoke exposures reach levels that violate NAAQS (Achtemeir et al., 2001). Public tolerance of smoke, however, sets the social limit of the number of acres burned and smoke produced from wildland fires. The level of acceptance varies from year to year and by community. Smoke may impact nursing homes, hospitals, and other populations sensitive to temporary air pollution. Smoke can also impact other areas such as local communities, transportation corridors, and highly valued scenic vistas.

With its number of acres being treated with wildland fire, there is a higher probability that **alternative D** would have more short-term impacts to forest visitors and local residents. These impacts could include smoke, areas of blackened or charred vegetation, and possibly delay or deny forest access due to fire activity. **Alternative A** would have fewer acres proposed for wildland fire treatments and, therefore, would have fewer short-term impacts followed by **alternatives C and B**, respectively.

The potential for nuisance smoke impacts to communities varies by alternative due to the number of acres burned and proximity of treatments. **Alternative D** treats the most acres with wildland fire, distributing the treatments among the Community-Forest Intermix Management Area (1/2 mile buffer around communities-at-risk) and priority watersheds. **Alternative B** emphasizes treatments within areas identified in the CWPPs. Potential smoke impacts to communities would be lessened because treatments are spread across the entire CWPP and not concentrated within the half-mile buffer of the Community-Forest Intermix Management Area. **Alternative C** emphasizes treatments within the Community-Forest Intermix Management Area. However, fewer acres are treated than in **alternatives B and D**, reducing the potential impacts to communities. The emphasis in **alternative A** is to treat around communities. However, this alternative treats the least number of acres by wildland fire so potential smoke impacts are reduced.

There is also a potential to have smoke impacts due to the mechanical treatments and subsequent burning of slash created by those treatments. Residual slash would be treated by prescribed fire. **Alternative C** mechanically treats the greatest number of acres within the Community-Forest Intermix Management Area which results in the highest potential for burning activity fuels in close proximity to communities. Even though **alternative B** mechanically treats the next highest number of acres, **alternative D** has more potential to impact communities due to the placement of treatments within the Community-Forest Intermix Management Area. **Alternative A** treats the least number of acres around communities.

Under **all alternatives**, the risk of uncharacteristic wildfire and subsequent smoke emissions is expected to increase in proportion to the acres left untreated (based on the average wildland fire and mechanical treatment objectives over the 15-year planning period). Untreated acres would have a greater overall fuel load and increased presence of ladder fuels over the long term. **Alternative D**, while creating the most short-term impacts to communities, would in the long term reduce potential smoke impacts by reducing the risk of uncharacteristic wildfires. **Alternative B** treats the next highest amount of acres followed by **alternatives C and A**, respectively. Treated acres would reduce fuel loads and ladder fuels resulting in a lower likelihood of crown fire and associated smoke impacts over the long term. See the “Air Quality” section in chapter 3 for more information on Class I airsheds and overall air quality.

Climate Change

There may be environmental consequences associated with climate change. Temperature changes may alter fire regimes (Sprigg and Hinkley, 2000). For instance, higher temperatures increase evaporation rates, and higher temperatures combined with a drier landscape increase wildfire hazard and put extra stress on ecosystems (Lenart, 2007). Fire frequency and severity may be exacerbated if temperatures increase, precipitation decreases, and overall drought conditions become more common. Seasonal timing of planned and unplanned wildland fires may be affected by climate change (e.g., if there are hotter drier seasons, fires may occur during times when areas would have usually been covered in snow). During the planning period, **alternatives B and D** followed by **alternatives C** and **A** would provide the most resiliency to climate change since they have the greatest amount of vegetation at desired condition (vegetation within or moving toward FRCC 1).

Cumulative Environmental Consequences

The area considered for this level of analysis includes adjacent land ownerships, national forests in Arizona, and the SMUs that cover the forests (Little Colorado River Airshed, Lower Salt River Airshed, and Upper Gila Airshed). Through CWPPs, there has been an emphasis to treat not only NFS lands but also private and State lands within the WUI. Communities are working to reduce the risk of wildfire to and from private lands by emphasizing community fire and fuels reduction programs. These efforts identified in **all alternatives,** in combination with treatments on adjacent Federal land, help to further reduce the risk of uncharacteristic wildfires to communities and the national forests.

Numerous national forests within Arizona are revising their land management plans. These plans would emphasis vegetation treatments that would improve FRCC. Neighboring tribal, State, and BLM lands are also conducting vegetation treatments. These efforts, in combination with Apache-Sitgreaves NFs’ treatments in **all alternatives**, would contribute to landscape restoration, overall improvement in FRCC, the return of wildfire to a more natural role, and a reduction in uncharacteristic wildfire across the broader landscape.

Neighboring land managers (e.g., tribes, Bureau of Land Management, Coconino and Tonto NFs) are also implementing projects that produce emissions (i.e., smoke). Considering these projects, wildland fire activities on the forests identified in **all alternatives,** and climatologic conditions, there may be additional impacts to air quality, visibility, and human health. Effects from multiple sources can affect the three SMUs that encompass the forests. Agencies within Arizona fall under the purview of the ADEQ air quality division and the State implementation plan; however, tribes cooperate with the ADEQ on a voluntary basis. ADEQ coordinates its issuance of burn permits among all the resource agencies to minimize the potential effects, including impacts to air quality and public safety, of numerous agencies prescribed fires concurrently.

Wildlife and Rare Plants

This section describes the affected environment for wildlife and rare plants. It also evaluates and discloses the potential environmental consequences on wildlife and plants of implementing four plan alternatives. As used in this section, “wildlife” is inclusive of all terrestrial and aquatic animal species (including invertebrates) and plants (including lichen, mosses, and fungi). For species of wildlife that are fish, see the “Fisheries” section. For this wildlife analysis, habitat is characterized as potential natural vegetation types (PNVTs) and also as “habitat elements” that occur within or across PNVTs (e.g., snags). Other factors of concern for wildlife are also considered. Before the affected environment and environmental consequences are covered, the analysis process and legal direction for wildlife and plants is discussed.

Wildlife species viability is addressed in fulfillment of National Forest Management Act (NFMA) direction (provisions of the 1982 Planning Rule). NFMA regulations direct that habitat be managed to maintain viable populations of native and desirable nonnative vertebrates within the planning area. A species is considered viable if the following conditions are met: (1) habitat is well distributed relative to reference conditions (see the “Terminology” section at the beginning of chapter 3), (2) the species occupies a substantial portion of its habitat where that habitat occurs across the planning area, and (3) management will maintain or restore (move) the habitat toward reference conditions. Plan direction for the maintenance or movement toward desired ecological conditions (see the “Purpose and Need for Change” section in chapter 1) is, for the most part, maintenance or movement toward reference conditions important for species viability (see the following wildlife analysis assumptions). These species-habitat relationships are evaluated in terms of viability effectiveness. For the analysis, how well each alternative addresses viability effectiveness is tallied by PNVT and by categories of species (e.g., sensitive species).

NFMA regulations also direct the identification of management indicator species (MIS) to assess how plan alternatives may affect wildlife populations (1982 Planning Rule section 219.19 (a)(1)) and as a monitoring tool upon plan implementation (219.19(a)(6)). Forest Service Manual 2620.5-2 direction allows identification of ecological indicators (EIs) such as plant communities that contribute substantially to species viability. Three MIS species and two EIs are identified and discussed in this section. Chapter 5 of the proposed plan includes monitoring for MIS and EIs.

In addition to the NFMA assessment of viability, other laws, regulations, and executive orders provide specific requirements and direction for the analysis of (1) Endangered Species Act species (ESA), (2) Regional Forester designated sensitive species (sensitive), (3) eagles, and (4) migratory birds. Most of these species are also discussed under the viability analysis. For ESA species, a biological assessment is prepared for consultation with the U.S. Fish and Wildlife Service (USFWS). Per Forest Service Manual direction, a biological evaluation is prepared for sensitive species. Executive Order 13186 requires the Agency to consider migratory birds in the planning process with an emphasis on species of concern and priority habitats. A separate report (Forest Service, 2014y) is prepared that addresses migratory birds of concern, bald and golden eagles, and important bird areas. All wildlife specialist reports are available in the “Plan Set of Documents” and their findings are included in this section.

Habitat security and connectivity, the amount of wildlife quiet areas, and the needs of far ranging species and their influence across large landscapes (i.e., highly interactive species) were concerns raised by the public during scoping (see the “Alternative Development” section in chapter 2). To address this issue, the revised plan would include wildlife habitat areas (i.e., wildlife quiet areas). Wildlife quiet areas together would compose a management area, also helping to contribute to species viability. The analysis examines (1) the number and acreage of management areas best providing for wildlife habitat security and connectivity and (2) the average distance between these management areas.

Diversity and Forest Planning Species

In anticipation of forest plan revision, a review of the diversity of wildlife on the forests was conducted beginning in 2007. Initially, over 2,000 species of wildlife were screened using a collaborative approach to identify which ones may be present or have suitable habitat in the planning area. Biologists from the Apache-Sitgreaves NFs and other plan revision forests, Arizona Game and Fish Department (AZGFD), The Nature Conservancy, universities, species specialists, and individuals or groups with wildlife interests assisted in this effort.

Based on a series of species status reviews, an evaluation was made to determine whether there may be risks to each species’ viability because habitat conditions are departed from reference conditions and/or because of species’ vulnerability to impacts from forest management or activities. Those species with risk are identified as forest planning species (FPS). Risks to viability were then considered in the development of plan direction and/or components. A few common species with limited risk (highly interactive species) are also identified as FPS. In total, there are 109 FPS, consisting of 14 fish and 95 non-fish species. Documentation of the FPS process is found in the “Iterative Update to Species Considered and Identification of Forest Planning Species Report” (Forest Service, 2012b). See the “Fisheries” section for analysis of the 14 FPS that are fish.

Provision for Species Viability

Historically, species persisted (were viable) having adapted to the risks associated with normal ecosystem functions (e.g., fire, drought) and the habitat conditions that resulted. Risk to species viability is also a result of human influences. Regardless of source, risks at some level can begin to threaten species viability; hence, in a general manner, risk and viability are inversely related.

To help ensure that the viability needs of species are addressed in the development of plan alternatives, possible risks from forest management and activities are identified. Goals or desired conditions that support native plant and animal diversity and viability are also identified; these goals are known as desired conditions. Desired conditions are reflective of reference conditions which historically supported these species (see assumptions below). This step in planning for viability is the coarse filter which also takes into account desired conditions for vegetation, soils, watershed, water, and aquatic/riparian resources, which contribute to habitat conditions that support species viability.

Another step in planning for viability is the fine filter, which is added where desired conditions do not fully address the habitat needs of species. Here, other plan components (i.e., standards and guidelines), are identified to address the fine filter habitat element needs of species (e.g., wet or shaded habitat areas). Standards and guidelines are also identified, as needed, for situations where there are other factors of concern (risks) related to activities (e.g., collection) or indirectly related to habitat (e.g., predation).

Because of the programmatic nature of forest planning, site specific measures for projects and activities may still be needed to address short-term implementation impacts and provide for species needs. These impacts are often a result of treatment methods (e.g., thinning, wildland fire) or timing of management activities. See the “Wildlife Specialist Report – Viability” (Forest Service, 2014bb) for more information.

Species Viability

The wildlife analysis characterizes risk from forest management and forest activities and the viability effectiveness of the alternatives. The determination of environmental consequences for 95 species, numerous habitat elements, and 4 plan alternatives is extremely complex. As such, the wildlife analysis relies heavily on an approach that categorizes or groups species and habitats. The general analysis process is described below, for more detail see appendix B.

F ranking variable: The existing condition of each FPS is expressed in terms of the species’ abundance and distribution on the planning unit. This variable is called a forest or F ranking (table 63). Note that rare species are most often associated with rare habitats which would not become common with management.

Table 63. Forest F rankings for forest planning species (FPS)

F Ranking	Description of Species Abundance and Distribution Relative to Reference or Desired Habitat Conditions
F? [a/]	Unknown abundance and distribution
F1	Extremely rare
F2	Rare
F3	Uncommon (including locally common but in rare locations)
F4 [b/]	Widespread
F5	Secure

[a] Because of insufficient information to determine abundance and distribution, F? species are analyzed as F1 species.

[b] Populations of some F4 species could be affected by extensive landscape scale management and activities depending on timing, both spatial and temporal.

Abundance and distribution of habitat: Abundant and well-distributed habitat provides for the continued persistence of a species. Habitat abundance (i.e., the quantity (acres) of habitat provided by a PNVT), generally changes little; however, in some cases the amount of suitable (i.e., quality) habitat acres can change such as when grassland becomes wooded or when uncharacteristic high severity fire or stand replacing wildfire completely removes the entire forest overstory. Habitat distribution, expressed in terms of the mix of vegetation states within a PNVT, can change with management, which is often the purpose of treatments.

Values for the future habitat abundance and distribution are estimated for the 15-year planning period with consideration of trend to 50 years. This is done for each PNVT and each habitat element by alternative. The values are based on different alternative treatment objectives along with treatment method (thin or wildland fire) and specific prescriptions. For more information, see the "Vegetation Specialist Report" (Forest Service, 2014t), "Forest Products Specialist Report" (Forest Service, 2014i), and the "Forest Health Specialist Report" (Forest Service, 2014h).

Likelihood of limitation variable: Habitat abundance and distribution values are combined to indicate the likelihood that a PNVT or habitat element would limit future populations of associated species based on management and activity implementation. In general, habitats that are poorly distributed or rare are most likely to have risk for associated species viability; while common or well-distributed habitats are least likely to have risk for their species viability.

Species viability risk rating variable: Species and habitats are linked by combining the species F ranking variable and the likelihood of limitation of associated PNVTs and habitat elements. Each species-habitat relationship is expressed as a viability risk rating by alternative.

The viability risk rating is determined for the 15-year planning period with consideration of trend to 50 years. Within their given habitat, widespread and abundant species generally have less risk and are more likely to persist, as compared to rare species with small populations. Viability risk ratings are described in table 64.

Table 64. Viability risk ratings reflecting species' F rank and likelihood of habitat limitation

Likelihood of Habitat Limitation	ranking	FPS F ranking		
	F? or F1	F2	F3	F4 / F5[a]
high	very-high	high	moderately-high	moderate/low[b]
moderate	high	moderately-high	moderate[b]	low/low[b]
low	moderately-high	Moderate[b]	Low[b]	low/low[b]

[a] F4 and F5 species are not species of viability concern but a few are considered FPS as highly interactive species.

[b] Moderate and low level risk ratings are considered no more substantial than normal ecosystem fluctuations.

Viability risk ratings of low and moderate are not considered substantial enough to threaten species viability (see assumptions). The three risk ratings of moderately high, high, and very high indicate further consideration of species needs is necessary (see the following coarse filter and fine filter discussion). The number of viability risk ratings in these three ratings is tallied for each species-habitat relationship. This facilitates comparison of alternatives by how effectively each addresses species viability. These are also tallied for three categories of species: ESA, sensitive, and the remaining FPS (except MIS).

Management effect variable: This variable categorizes the relative expected outcome of management and activities in terms of minimizing species viability risk. Management effect, by alternative, is determined for each PNVT and habitat element. It is based on how well plan objectives maintain or move habitat toward (i.e., reduce departure from) desired conditions as a result of alternative treatment objectives. Management effect is determined for the 15-year planning period. Movement toward desired conditions reflects desired changes in the mix of vegetation states to provide suitable habitat. Management effect ratings are described in table 65.

Management effect rating outcomes (the numbers of management effect categories across PNVTs and habitat elements) are tallied in order to compare how effectively each alternative addresses species viability. The numbers are also tallied for three categories of species: ESA, sensitive, and the remaining FPS (except MIS).

Table 65. Description of relative management effect rating for alternatives

Rating	Management Effect Outcomes Based on Alternative Objectives
1	Greatest relative improvement or maintenance of habitat abundance and distribution through management and activities.
2	Intermediate relative improvement or maintenance of habitat abundance and distribution through management and activities.
3	Least to no relative improvement or maintenance of habitat abundance and distribution as a result of management/activities or lack of thereof (or by factors outside of Forest Service control).

Environmental consequences: The viability risk rating outcomes and the management effect rating outcomes form the basis for the determination of environmental consequences to FPS, expressed as the relative “viability effectiveness” for each alternative. Appendix B provides more information on the analysis process. Details and results of the analysis can be found in the “Wildlife Specialist Report – Viability” (Forest Service, 2014bb).

Species Viability Assumptions

Assumptions for the wildlife analysis include the following:

- If a species is associated with a particular habitat, then the quality and quantity of habitat elements available to the species help to predict its distribution and abundance within that habitat.
- Habitat abundance and distribution similar to that which supported associated species during conditions as a consequence of evolutionary time, will likely contribute to their maintenance in the future (Haufler, 1999). Therefore, habitat abundance and distribution similar to reference condition will likely contribute to associated species maintenance in the future.
- Desired conditions are synonymous with reference conditions with the exception of three PNVTs where desired conditions were adjusted from reference conditions as follows: In the dry mixed conifer and Madrean pine-oak woodland PNVTs, vegetation states to reflect needed habitat conditions for the threatened Mexican spotted owl (e.g., closed

canopies) are included in desired conditions. In ponderosa pine, vegetation states to reflect needed habitat conditions for the sensitive northern goshawk (e.g., large trees) are included in desired conditions.

- In general, the further a habitat is departed from desired conditions (i.e., from reference or reference adjusted conditions), the greater the risk to viability of associated species and the less the alternative’s viability effectiveness. Conversely, the closer a habitat is to desired conditions, the lower the risk to viability of associated species and the greater the alternative’s viability effectiveness.
- Low to moderate ratings of species viability risk are considered no more substantial than normal ecosystem fluctuations and within a species’ ability to adjust and, therefore, pose no risk to viability. Hence, only moderately high, high, and very high viability risk ratings are used to develop further plan components to assure viability and used to compare alternatives.
- The evaluation of environmental consequences to species viability is framed as a risk assessment in terms of alternative viability effectiveness. However, there is a level of uncertainty about the projected effects of forest management and activities on species viability because of gaps in knowledge about the complex interaction between species and their habitats (Holthausen, 2002). Because of this uncertainty and impacts outside of Forest Service control, monitoring, as identified in chapter 5 of the proposed plan, will take place, thereby facilitating adaptive management and changes, as needed, to support ongoing species viability.
- Acreage of each PNVT is static because it is based on geology, soils, and climate. However, the acreage of states within a PNVT varies due to disturbance and management (Forest Service, 2014t). As such, PNVT states (i.e., habitat conditions that are most suitable for a particular FPS) vary among alternatives.

Affected Environment

Wildlife and Rare Plants

The Apache-Sitgreaves NFs provide some of the most diverse habitats on national forests in the Southwestern Region. These habitats span almost 8,000 feet in elevation, ranging from semi-desert grasslands at about 3,500 feet to spruce-fir forests at about 11,400 feet. A large portion of the forests is ponderosa pine (part of the largest, contiguous ponderosa pine forest in the world); yet, the forests also contain much of the acreage in unique habitats of the Southwestern Region. These habitats include montane and subalpine grasslands, extensive wetlands (including bogs and fens), and the headwaters of major river systems in Arizona (Blue, Black, San Francisco, and Little Colorado). The forests encompass over 2,000 miles of rivers and perennial streams and more than 30 lakes and reservoirs. Both extensive and unique habitats support species ranging from one of the largest elk herds in Arizona to rare species like the Three Forks springsnail which only occurs on the Apache-Sitgreaves NFs. These diverse habitats and the wildlife they support help draw upward of 2 million visitors to the forests annually.

The following sections detail the affected environment or existing condition of wildlife and rare plants and their habitats.

Habitat

The following sections describe habitat at two levels: (1) the PNVT(s) or the coarse filter for meeting species needs and viability and (2) the habitat element(s) (e.g., wet meadows or large snags) or the fine filter for further assuring species viability. Viability needs of species associated with the coarse filter PNVT are generally met by providing PNVT desired conditions or movement toward them, while standards and guidelines help meet the viability needs of species associated with fine filter habitat elements. However, the coarse-fine filter approach is not entirely discrete in that standards and guidelines can contribute to viability for some coarse filter species, while the needs of fine filter species can also be provided for, in part, by the coarse filter desired conditions of PNVTs.

PNVTs and Habitat Elements for Forest Planning Species

Table 66 lists wildlife habitat provided by PNVTs and habitat elements, along with associated FPS. Note that not all of the PNVTs are listed. Two PNVTs are not departed from their reference conditions (interior chaparral and piñon-juniper woodland) and they have no associated species with viability concerns. Because of the diversity of riparian habitats and species, riparian habitat needs are primarily addressed at the fine filter level. These riparian habitat elements are also shown in the table with associated FPS.

Table 66. PNVTs (coarse filter) and habitat elements (fine filter) of importance to species viability, showing associated forest planning species

PNVTs (coarse filter) Habitat Elements (fine filter)	Associated Forest Planning Species (FPS)
Forested PNVTs (4)	
Ponderosa Pine Forest (PPF)	Arizona myotis bat, Abert's squirrel, northern goshawk, zone-tailed hawk, Grace's warbler, flammulated owl, Mexican spotted owl (where Gambel oak occurs)
Sometimes shaded or often wet meadow or forest opening	Mogollon vole, Merriam's shrew, four-spotted skipperling butterfly, Arizona sneezeweed, Mogollon clover, Oak Creek triteleia
Dry Mixed Conifer Forest (DMCF)	Arizona myotis bat, red squirrel, northern goshawk, flammulated owl, Mexican spotted owl
Cool understory microclimate	Goodding's onion
Dense, low-mid canopy with ample ground vegetation/litter and/or woody debris	black bear, red-faced warbler
Sometimes shaded or often wet meadow or forest opening	Merriam's shrew
Wet Mixed Conifer Forest (WMCF)	red squirrel, black bear, northern goshawk, red-faced warbler, Mexican spotted owl, White Mountains paintbrush[a], yellow lady's slipper, wood nymph, heathleaf ragwort, yellow Jacob's-ladder, hooded lady's tresses
Dense, low-mid canopy with ample ground vegetation/litter and/or woody debris	White Mountains chipmunk, Swainson's thrush, southern red-backed vole, dusky blue grouse

PNVTs (coarse filter) Habitat Elements (fine filter)	Associated Forest Planning Species (FPS)
Spruce-Fir Forest (SFF)	red squirrel, black bear, Mexican spotted owl, crenulate moonwort, White Mountains paintbrush[a], yellow lady's slipper, wood nymph, heathleaf ragwort, yellow Jacob's-ladder, hooded lady's tresses
Dense, low-mid canopy with ample ground vegetation/litter and/or woody debris	White Mountains chipmunk, Swainson's thrush, southern red-backed vole, dusky blue grouse
Woodland PNVT (1)	
Madrean Pine-Oak Woodland (MPOW)	mule deer (winter), juniper titmouse, Mexican spotted owl (often in association with canyons), gray vireo, Bigelow's onion
Cool understory microclimate	Mexican hemlock parsley
Mosaic of conditions[c]	Greene milkweed
Grassland PNVTs (3)	
Montane/Subalpine Grasslands (MSG)	pronghorn antelope, Gunnison's prairie dog, dwarf shrew, savannah sparrow, splachnoid dung moss
Seasonally wetted swales	Ferris' copper butterfly, Alberta arctic butterfly, nitocris fritillary butterfly, nokomis fritillary butterfly
Mosaic of conditions[c]	long-tailed vole, dwarf shrew, White Mountains ground squirrel
Great Basin Grassland (GBG)	pronghorn antelope, Gunnison's prairie dog, Arizona sunflower
Seasonally wetted swales	Parish alkali grass (alkali soils only)
Mosaic of conditions[3]	Springerville pocket mouse, White Mountains ground squirrel, western burrowing owl, Montezuma's quail, Greene milkweed
Semi-Desert Grassland (SDG)	Bigelow's onion, Arizona sunflower, superb penstemon
Mosaic of conditions[3]	lesser long-nosed bat, Montezuma's quail, plateau giant tiger beetle
Across All PNVTs	
Canyon slopes/cliffs, caves, rocky slopes (often in vicinityof riparian areas, often cool microclimate)	Townsend's big-eared bat, spotted bat, greater western mastiff bat, Allen's big-eared bat, peregrine falcon, Eastwood alumroot[b], Arizona alumroot[b], Davidson's cliff carrot (primarily within PPF, MPOW)
Habitat connectivity	Mexican wolf, jaguar, mountain lion, black bear

PNVTs (coarse filter) Habitat Elements (fine filter)	Associated Forest Planning Species (FPS)
Riparian PNVTs (4)[d]	
Mixed Broadleaf Deciduous Riparian Forest (MBDRF), Cottonwood-Willow Riparian Forest (CWRF), Montane Willow Riparian Forest (MWRF), Wetland/Cienega Riparian Areas (WCRA)	
High water quality—all Riparian PNVTs	water shrew, bald eagle, Arizona toad, Chiricahua leopard frog, northern leopard frog, lowland leopard frog, northern Mexican gartersnake, narrow-headed gartersnake, false ameletus mayfly, California floater, Mosely caddisfly, Arizona snaketail dragonfly, White Mountains water penny beetle, Three Forks springsnail, Blumer's dock, carnivorous bladderwort
Healthy riparian conditions (i.e., well vegetated and untrampled streambanks and floodplains—all Riparian PNVTs (unless otherwise specified)	Arizona montane vole, water shrew, New Mexico meadow jumping mouse, southwestern willow flycatcher, peregrine falcon, Lincoln's sparrow (MWRF), Mexican spotted owl, northern Mexican gartersnake (below Mogollon Rim), narrow-headed gartersnake (above Mogollon Rim), Blumer's dock, Arizona willow (MWRF only), Bebb willow
Large trees, snags and/or dense canopies—MBDRF (unless otherwise specfied)	beaver (all riparian forests), greater western mastiff bat, Allen's big-eared bat, Arizona gray squirrel, common black-hawk, yellow-billed cuckoo, bald eagle (all riparian forests), Mexican spotted owl (all riparian forested PNVTs), evening grosbeak (all riparian forests)
Dense low-mid canopy with ample ground litter—MBDRF	western red bat, ocelot, southwestern willow flycatcher (MWRF), MacGillvray's warbler (all riparian forested PNVTs), gray catbird (all riparian forests), black bear
Permanent wet meadow-like areas—WCRA	Ferris' copper butterfly, nitocris fritillary butterfly, nokomis fritillary butterfly

[a] White Mountains paintbrush classified as either *Castilleja mogollonica* or *C. sulpure*

[b] Eastwood alumroot also known as Senator mine alum root and Arizona alumroot also known as Chiricahua Mountain alumroot.

[c] Mosaic of conditions indicates these species need adjacent untreated areas for persistence within the PNVT.

[d] Because of the great diversity of conditions in the riparian PNVTs, some important fine filter habitat elements are identified beyond desired conditions. Note that fish are addressed in the prior "Fisheries" section.

The amount and current condition of coarse filter PNVTs providing habitat are described in affected environment of the "Vegetation" section. Although FPS associated with a particular PNVT do not typically use every acre of the PNVT, the total PNVT acreage is considered suitable habitat and potentially occupied for this analysis unless otherwise noted. The amount and current condition of fine filter habitat elements is not available on a forestwide basis (it is normally determined on a project-level basis). However, table 67 provides a general description of existing condition for each habitat element and its associated risks to viability. This is based, in part, on information in the "Riparian Specialist Report" and "Vegetation Specialist Report" (Forest

Service, 2014q and 2014t). Even where some habitat element locations are not currently used by FPS, all are considered suitable habitat that is potentially occupied unless otherwise noted.

Table 67. Description of fine filter habitat elements and risks

Fine Filter Habitat Elements[a]	Description of General Existing Condition and Risks
Sometimes shaded or often wet meadow or forest opening (PPF, DMCF, and WMCF)	Mostly small areas (one-quarter acre, sometimes more or less) within forest and woodland PNVTs with no trees that are dominated by herbaceous vegetation, often with cool season[b]/ herbaceous forage due to moister soil conditions or shading from adjacent trees. High to moderate intensity fire and extensive thinning can dry and warm these areas. Concentrated livestock use can change herbaceous vegetation structure and composition (shifts to warm season and lower seral state vegetation and introduce nonnative invasive plants), decrease ground cover, cause soil compaction, and increase erosion. These risks are most likely on lower elevation, yearlong allotments which comprise about 797,000 acres on the forests.
Cool understory microclimate (DMCF, MPOW)	Not openings among trees but rather cool, moist areas under dense trees with high canopy closure, where summer temperatures and high winds are mitigated. High to moderate intensity fire and extensive thinning can dry and warm these areas, changing herbaceous vegetation structure and composition. The Wallow Fire resulted in the complete loss of forest canopy on over 50,000 acres within these two PNVTs[c] with the associated loss of this habitat element.
Dense, low-mid canopy with ample ground litter or woody debris (DMCF, WMCF, SFF, and MBDRF)	Dense low and/or mid canopies provide foraging and nesting habitat, necessary hiding and travel cover, and help limit detection by predators. Ample ground cover and woody debris provide habitat structure (e.g., cover) and associated forage plants. These areas increase habitat effectiveness (carrying capacity) because more individuals of certain FPS can persist in locations where cover is denser. High to moderate intensity fire and extensive thinning can degrade hiding and travel cover. The Wallow Fire resulted in the complete loss of forest canopy on almost 106,000 acres[c] within these four PNVTs with the associated loss of this habitat element.
Seasonally wetted swales (MSG and GBG)	Low areas with greater seasonal moisture inflow or wetted from below; these can be small or, in the MSG, extensive in size (40 acres or more). They provide denser, often more diverse, and often cool season[b/] herbaceous forage. High to moderate intensity fire and extensive thinning can dry and warm these areas. Concentrated livestock use can change herbaceous vegetation structure and composition (shifts to warm season and lower seral state vegetation and introduce nonnative invasive plants), decrease ground cover, cause soil compaction, and increase erosion. These risks are most likely on lower elevation, yearlong allotments which comprise about 797,000 acres on the forests and on seasonal allotments with May and June livestock use every year about 514,000 acres on the forests.
Canyon slopes, cliffs/caves, rocky slopes—often in vicinity of riparian areas or often providing cool micro-climate conditions due to aspect (across all PNVTs)	All are found across the forests (roughly 18 percent of the acreage on the forests is over 40 percent slope with most of that on the Apache side of the forests). Although typically limited in such areas, fire which burns hotter on steep slopes can impact plants, while human activity can disturb foraging or roosting bats and nesting birds.

Fine Filter Habitat Elements[a]	Description of General Existing Condition and Risks
High water quality (all Riparian PNVTs)	All associated aquatic and semiaquatic species. All are susceptible to degradation of water quality and sedimentation from management and activities. Sediment can smother invertebrates, smother prey eggs and larvae, clog invertebrate prey habitat, and reduce oxygen needed by fish prey species. There are over 2,000 miles of riparian corridors (both perennial and intermittent) including many of the State’s headwater streams, all of which have experienced channel changes and sedimentation impacts over time. However, management and activity impacts have been reduced or removed resulting in improved water quality in numerous locations over the last decade.
Healthy riparian conditions, (e.g., well vegetated and untrampled streambanks and floodplains)—all Riparian PNVTs (unless otherwise specified)	Dense, untrampled herbaceous vegetation and uncompacted stream or drainage banks and floodplains provide habitat structure and forage, as well as hunting cover and nesting sites. These conditions allow for vigorous, successfully reproducing plants that protect banks and floodplains. Wildfire and all but low intensity prescribed fire can reduce plant and woody debris cover and lead to sedimentation. Thinning and all ungulate use can trample or remove vegetation and lead to soil compaction and erosion. Many riparian locations have reduced ground cover, damaged banks, and compositional shift to lower seral state vegetation (see the following Riparian ecological indicator section for more information.
Large trees and/or dense canopies (MBDRF, CWRF, and MWRF)	Provides roosting, nesting, hiding, and foraging habitat for FPS or their prey. Although generally limited in riparian areas, all but low intensity fire can easily weaken or kill woody riparian vegetation (flooding is its primary ecological disturbance). Livestock and wild ungulate use, especially during spring and early summer, have impacted the successful regeneration of woody species in numerous locations. In total, there are over 48,000 acres of riparian habitat on the forests.
Large snags[d] (MBDRF and CWRF)	Provide nesting, roosting, and foraging habitat. Although generally limited in riparian areas, all but low intensity fire can weaken or topple large snags. The 2002 Rodeo-Chediski Fire burned many snags in CWRF. Overall, burn out operations along the Blue River for the 2011 Wallow Fire had limited impact on large snags in MBDRF. The number of large snags is not available for these PNVTs.
Permanent wet meadow-like areas (WCRA)	Moist ground surface and vegetation along with flowers provide egg laying and foraging habitat for FPS invertebrates and foraging and hiding cover for small FPS mammals. High to moderate intensity fire and concentrated livestock use can dry these areas out, changing herbaceous vegetation structure and composition (shifts to warm season[b] and lower seral state vegetation), decrease ground cover, cause soil compaction, and lower the water table. The majority of these areas occur at higher elevations (>7,500 feet) and there are over 20,000 acres in this PNVT. These risks are most likely in locations where livestock grazing use occurs every year during May and June (about 564,000 acres on the forests).

[a] Parentheses ( ) indicates the PNVT where a habitat element most commonly falls within.

[b] Because a greater percentage of moisture falls during the summer period in the Southwest, most herbaceous plant species do the majority of their growth during the warm summer months (warm season growing plants) and forage is typically abundant during this period unless droughty; however, fewer plants do the majority of their growth during the spring to early summer (May and June) period (cool season growing plants) based on winter moisture so there is limited herbaceous forage during the period before summer rains and, additionally, most cool season plants are found in riparian areas where foraging is often concentrated during spring and early summer.

[c] Acreage with tree basal area (BA) loss of 75 to 100 percent which reflects complete (100 percent) loss of all trees based on the 7/18/11 RVAG mapping provided by USFS Remote Sensing Applications Center.

[d] While desired conditions for forested and woodland PNVTs address needed snags at the coarse filter, the riparian desired conditions do not.

Habitat Ecological Indicators (EIs)

Ecological indicators (EIs) are selected to estimate the effects of each alternative upon biological diversity. They provide an indirect way to estimate how forest management and activities influence species associated with important habitats. The "Report on the Selection of Management Indicator Species and Ecological Indicators" (Forest Service, 2012d) documents the indicator selection process.

Aspen and riparian are two vegetation communities that are important to the viability of many species. They were selected as EIs according to direction in Forest Service Manual 2621.1. Existing condition for these two EIs follow.

Aspen EI

Aspen occurs primarily within the forested PNVTs. Aspen stands provide a wide range of habitat for wildlife, including migratory birds. Aspen leaves provide forage in summer and the bark provides winter forage. Aspen stands can have twice the density and diversity of insects as compared to pure conifer stands, supporting many species of wildlife (Simard et al., 2001). Aspen stands also provide preferred cavity nesting sites for a large number of birds (Martin et al., 2004). Given the regeneration of existing aspen and anticipated new appearances of aspen (via seeding) after the Wallow Fire, this EI is expected to play a major role in the viability of many species during the life of the land management plan (see the affected environment of the "Vegetation" and "Forest Health" sections for more information).

Prior to the 2011 Wallow Fire, trend for this habitat community was static to down due to conifer encroachment and browsing. Aspen have been observed to be root-sprouting prolifically after the fire; therefore, it could be inferred that the trend is now up. Table 68 depicts the amount of aspen habitat as of 2012, after the Wallow Fire. However, while aspen acreage across forested PNVTs is expected to increase, the extent of that is unknown, as is aspen's ability to persist over time given domestic and wild herbivory, and impacts from removal of hazard and salvaged trees.

Table 68. Aspen within forested PNVTs, existing condition in 2012 (post-Wallow Fire)

Ponderosa Pine	Wet Mixed Conifer	Dry Mixed Conifer	Spruce-Fir	Total
Total Acreage of Forested PNVTs Containing Aspen				
602,206 acres	177,995 acres	147,885 acres	17,667 acres	945,753 acres
Amount of Aspen within each Forested PNVT				
5,988 acres 1.0%	50,355 acres 28.3%	14,232 acres 9.7%	5,875 acres 33.3%	76,506 acres 8.1%

Desired conditions for forest types containing aspen are the coarse filter for assessing associated FPS viability. In addition, aspen EI monitoring, upon plan implementation, would determine the response to and persistence of aspen over time to recent large fires, subsequent ungulate use, tree removal, and any climate change. Monitoring (proposed plan chapter 5) would inform adaptive management and any need for change.

Riparian EI

The cottonwood-willow riparian forest PNVT (CWRF) and the montane willow riparian forest PNVT (MWRF) represent a substantial portion of the riparian forests across the Southwestern Region (up to 78 percent of the regional acreage for the latter). The CWRF is the largest riparian PNVT on the Apache-Sitgreaves NFs, and the MWRF is the smallest but particularly subject to impacts (e.g., browsing, trampling). These three riparian forested PNVTs are together considered the riparian ecological indicator for the Apache-Sitgreaves NFs[29].

The 2005 and 2006 midscale vegetation inventory determined the existing condition of riparian overstory vegetation relative to reference condition. Overall, existing conditions reflect low departure from reference or desired condition in terms of riparian canopy composition and structure. However, based on some historic photographs from the first half of the 20th century (Forest Service, 2010e), it appears that the extent of woody riparian vegetation has been substantially reduced in some areas.

Reference conditions in riparian understories are not as well understood. However, monitoring across the forests over the last decade has found that riparian area soils and herbaceous vegetation (e.g., grasses, forbs) and deciduous trees and shrubs (e.g., cottonwoods, willows) receive far greater impacts from browsing ungulates (domestic and wild) than the uplands. This is especially true where ungulates are present during the winter and spring periods when there is little other forage that provides adequate nutrition. Road and recreation activities also contribute to existing conditions (e.g., sedimentation, trampling).

Proper functioning condition (PFC) riparian surveys to determine how well riparian processes are functioning (e.g., vegetation bank cover and stability, woody debris) have been conducted across the Apache-Sitgreaves NFs. Based on PFC riparian surveys conducted in the last 15 years, many riparian areas were not at proper functioning condition prior to the Wallow Fire. The majority of stream segments on 9 of 12 streams in the Little Colorado River watersheds were not in proper functioning condition; the majority of stream segments on all streams in the San Francisco, Black River, and Eagle Creek watersheds were not in proper functioning condition; and the majority of stream segments on 6 of 7 streams in other watersheds were also not in proper functioning condition. However, in the last 15 years, a number of riparian drainages have been excluded from primarily livestock impacts and are in the process of recovering.

The 2011 Wallow Fire impacted riparian forested PNVTs, but overall, not substantially. Of the 15,876 acres in CWRF, only 1.5 percent received moderate to high severity burn. Of the 4,808 acres in MWRF, just fewer than 14 percent burned at these levels. However, the long-term indirect impact from heavy post-fire flooding has not been assessed. Since woody riparian species in these PNVTs typically resprout, PNVT acreage is not considered reduced by the Wallow Fire for this analysis, although succession is set back to earlier seral states in burn areas.

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[29]The other two riparian PNVTs, wetland/cienega riparian area and mixed broadleaf deciduous riparian forest, were not included in the riparian ecological indicator. The former is typically already monitored since its a critical area for livestock grazing, so there is no need to also monitor it as an ecological indicator. The latter occurs along larger streams and rivers within large watersheds with multiple impacts making it difficult to assess the effects of any given forest management action.

Table 69 describes current understory (herbaceous and soil) conditions taken from the “Riparian Specialist Report” (Forest Service, 2014q) and “Vegetation Specialist Report” (Forest Service, 2014t) and reflects post-Wallow Fire conditions.

Table 69. Existing understory/herbaceous condition of the riparian ecological indicator (EI)

Riparian EI by PNVT	Decline in Ground Cover from Potential	Decline in Herbaceous Production from Potential	Ecological Condition	Current Trend Relative to Desired Conditions for Understory Vegetation/ Soils
Cottonwood-willow riparian forest	11–46%	56%	low–moderate	away/away
Montane willow riparian forest	up to 20%	91%	low–moderate	away/away

Because of the normal sensitivity of riparian habitat and major watershed adjustments (movement of soil, reestablishment of vegetation) after the Wallow Fire, ongoing species viability is an important consideration in riparian areas. Riparian EI monitoring, upon plan implementation, would determine the response of especially understory components (e.g., young trees, stream banks) to management and activities. Monitoring (proposed plan chapter 5) would inform adaptive management and any need for change.

Other Factors of Viability Concern

Other factors of viability concerns raised by biologists and others, some related indirectly to habitat, include factors such as disease, harassment, and entrapment. These are generally addressed by fine filter guidelines. Table 70 lists these factors and affected FPS.

Table 70. Other factors of concern and affected forest planning species (FPS)

Other Factors of Concern (fine filter)	Forest Planning Species (FPS)
Collection or loss from management	nitocris fritillary butterfly, nokomis fritillary butterfly, yellow lady's slipper, hooded lady's tresses
Nest parasitism	southwestern willow flycatcher, Grace's warbler
Disease	Townsend's big-eared bat, spotted bat, western red bat, Arizona toad, Chiricahua leopard frog, northern leopard frog, lowland leopard frog
Entrapment	FPS that are small mammals, bats, and young of other species
Substantial predation or competition from invasive species	pronghorn antelope, Three Forks springsnail
Intentional harassment, forced removal, or avoidable disturbance	Mexican wolf, Gunnison's prairie dog, black bear, many FPS (at least during important life cycle periods)

Some species collection activities are under special use permit on the forests; however, collection is likely much greater than known. The density of forest roads currently impacts habitat connectivity and can contribute to harassment or disturbance. The level of nest parasitism and extent of disease is unknown. However, inventory and non-mechanized work in riparian areas generally incorporates USFWS aquatic disease decontamination protocol. A deadly fungus (white nose syndrome) in bats can be spread by human presence in caves; the disease is not yet known in Arizona. Wildlife entrapment is not uncommon in water troughs and occasionally fences. Currently some troughs have escape ramps but most do not and some fences meet wildlife needs for passage while others do not. The springsnail has been greatly impacted by the proliferation of crayfish over the last decade. Efforts to remove crayfish have had mixed results because, while numbers of adults are reduced, numbers of young are not.

Forest Planning Species

The 95 non-fish forest planning species (FPS) comprise 8 ESA species, 53 Regional Forester sensitive species, and 34 other species. The latter 34 species hold no special regulatory status except as addressed for viability under NFMA. Public scoping identified six FPS (mammals) as highly interactive (HI) species for which there are landscape level concerns relative to habitat security and connectivity (one highly interactive species is an ESA and another is a sensitive species, while four are other species). Fish that are FPS are addressed in the prior "Fisheries" section.

Table 71 characterizes the existing condition of FPS in terms of their abundance and distribution (F ranking), along with associated PNVTs and habitat elements. It also lists their status as of 2012. Note that a species can have more than one status, and status can change over time. FPS are grouped as follows: 30 mammals, 22 birds, 6 reptiles/amphibians, 12 invertebrates, and 25 plants. FPS that are also ESA, sensitive, and highly interactive (HI) are further discussed after the table.

Table 71. FPS, their status, F ranking, associated PNVTs and habitat elements

FPS by	Species Group	Status[a]	F Ranking[b]	PNVT Habitat Element[c]
Mammals (30)				
pronghorn antelope	*Antilocapra america*	HI	F4	GBG, MSG, substantial predation
Mexican wolf	*Canus lupus baileyi*	ENE, HI	F1	habitat connectivity, intentional harassment
beaver	*Castor canadensis*	HI	F4	large trees (riparian forested PNVTs)
southern red-backed vole	*Clethrionomys (Myodes) gapperi*	S	F?	ample litter and woody debris (WMCF, SFF)
Townsend's big-eared bat	*Corynorhinus townsendii pallenscens*	S	F?	caves, disease
Gunnison's prairie dog	*Cynomys gunnisoni*	S, HI	F?	GBG, MSG, intentional harassment
spotted bat	*Euderma maculatum*	S	F1	wet meadow (PPF, DMCF), wet swales (MSG, GBG), cliffs
greater western mastiff bat	*Eumops perotis californicus*	S	F?	large trees (MBDRF), cliffs
Allen's big-eared bat	*Idionycteris phyllotis*	S	F3	large trees and snags (MBDRF), cliffs
western red bat	*Lasiurus blossevillii*	S	F2	ample debris and litter (MBDRF), caves, disease
ocelot	*Leopardus pardalis*	E	F?	dense, low vegetation and cover (MBDRF)
lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	E	F?	mosaic of conditions (SDG)
long-tailed vole	*Microtus longicaudus*	S	F3	wet swales (MSG)
Arizona montane vole	*Microtus montanus arizonensis*	S	F3	healthy riparian conditions (CWRF, MWRF)
Mogollon vole	*Microtus mogollonensis mogollonensis*	S	F3	wet meadow (PPF)
Arizona myotis bat	*Myotis occultus*		F3	PPF, DMCF
mule deer	*Odocoileus hemionus*		F4	MPOW, winter
jaguar	*Panther onca*	E	F?	habitat connectivity (MBDRF)
Springerville pocket mouse	*Perognathus flavus goodpasteri*	S	F3	mosaic of conditions (GBG)
mountain lion	*Puma concolor*	HI	F5	habitat connectivity (all PNVTs)

FPS by	Species Group	Status[a]	F Ranking[b]	PNVT Habitat Element[c]
Abert's squirrel	*Sciurus aberti*		F4	PPF
Arizona gray squirrel	*Sciurus arizonensis arizonensis*	S	F?	large trees (MBDRF)
Merriam's shrew	*Sorex merriami*	S	F3	wet meadow (PPF, DMCF)
dwarf shrew	*Sorex nanus*	S	F3	MSG
water shrew	*Sorex palustris navigator*	S	F?	water quality (CWRF, MWRF), healthy riparian conditions (CWRF,MWRF)
White Mountains ground squirrel	*Spermophilus tridecemlineatus monticola*	S	F3	mosaic of conditions (MSG, GBG)
White Mountains chipmunk	*(Neo)Tamias minimus arizonensis*	S	F3	ample veg, woody debris (WMCF, SFF)
red squirrel	*Tamiasciurus hudsonicus*		F4	DMCF, WMCF, SFF
black bear	*Ursus americanus*	HI	F4	dense low-mid canopy, woody debris (DMCF), WMCF, SFF, habitat connectivity
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	E	F1	healthy riparian conditions (all riparian PNVTs)
Birds (22)				
northern goshawk	*Accipiter gentilis*	S	F4	PPF, DMCF, WMCF
western burrowing owl	*Athene cunicularia hypugaea*	S	F?	GBG
juniper titmouse	*Baeolophus ridgwayi*		F4	MPOW
zone-tailed hawk	*Buteo albonotatus*	S	F3	PPF
common black-hawk	*Buteogallus anthracinus*	S	F3	large trees (MBDRF)
red-faced warbler	*Cardellina rubrifrons*		F3	dense, low vegetation and litter (DMCF), WMCF
Swainson's thrush	*Catharus ustulatus*		F2	ample litter and woody debris (WMCF, SFF)
evening grosbeak	*Coccothraustes vespertinus*		F3	dense canopies (riparian forested PNVTs)
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	pT	F1	large trees, dense canopies (forested riparian PNVTs)
Montezuma quail	*Cyrtonyx montezumae mearnsi*		F3	mosaic of conditions (GBG, SDG)

FPS by	Species Group	Status[a]	F Ranking[b]	PNVT Habitat Element[c]
dusky blue grouse	*Dendragapus obscurus*		F2	ample woody debris (WMCF, SFF)
Grace's warbler	*Dendroica graciae*		F4	PPF, nest parasitism
gray catbird	*Dumetella carolinensi*	S	F3	dense low-mid canopy (riparian forested PNVTs)
southwestern willow flycatcher	*Empidonax traillii extimus*	E, CH	F1	dense low-mid canopy (MWRF), healthy riparian conditions (MWRF), nest parasitism
peregrine falcon	*Falco peregrinus anatum*	S	F3	Cliffs, healthy riparian conditions
bald eagle	*Haliaeetus leucocephalus*	S	F2	water quality (CWRF, MBDRF), large trees (CWRF, MBDRF)
Lincoln's sparrow	*Melospiza lincolnii*		F1	healthy riparian conditions (MWRF)
MacGillivray's warbler	*Oporornis tolmiei*		F2	dense low-mid canopy (riparian forested PNVTs)
flammulated owl	*Otus flammeolus*		F3	PPF, DMCF
savannah sparrow	*Passerculus sandwichensis*		F3	MSG
Mexican spotted owl[d]	*Strix occidentalis lucida*	T, CH	F3	DMCF, WMCF, MPOW, PPF where Gambel oak
gray vireo	*Vireo vicinior*	S	F2	MPOW
Amphibians/ Reptiles (6)				
Arizona toad	*Bufo microscaphus*	S	F3	water quality (MBDRF), disease
Chiricahua leopard frog	*Lithobates chiricahuensis*	T, pCH	F1	water quality, disease
northern leopard frog	*Lithobates pipiens*	S, C	F1	water quality, disease
lowland leopard frog	*Lithobates yavapaiensis*	S	F3	water quality, disease
northern Mexican gartersnake	*Thamnophis eques megalops*	T	F?	water quality, healthy riparian conditions
narrow-headed gartersnake	*Thamnophis rufipunctatus*	T	F1	water quality, healthy riparian conditions
Invertebrates (12)				
plateau giant tiger beetle	*Amblycheila picolominii*		F?	mosaic of conditions (SDG)
false ameletus mayfly	*Ameletus falsus*		F?	water quality

FPS by	Species Group	Status[a]	F Ranking[b]	PNVT Habitat Element[c]
California floater	*Anodonta californiensis*	S	F1	water quality
Mosely caddisfly	*Culoptila moselyi*		F?	water quality
Ferris' copper butterfly	*Lycaena ferrisi*[e]	S	F2	wet swale (MSG), WCRA
Alberta arctic butterfly	*Oeneis alberta daura*		F3	mosaic of conditions (MSG)
Arizona snaketail dragonfly	*Ophiogomphus arizonicus*	S	F?	water quality
four-spotted skipperling butterfly	*Piruna polingii*	S	F3	wet meadow or shaded opening (PPF)
White Mountains water penny beetle	*Psephenus montanus*		F1	water quality
Three Forks springsnail	*Pyrgulopsis trivialis*	E, CH	F1	water quality, predation by invasives
nitocris fritillary butterfly	*Speyeria nokomis nitocris*	S	F3	wet swales (MSG), WCRA, collection
nokomis fritillary butterfly	*Speyeria nokomis nokomis*	S	F3	wet swales (MSG), WCRA, collection
Plants (25)				
Bigelow's onion	*Allium bigelovii*		F3	MPOW, SDG
Goodding's onion	*Allium gooddingii*	S	F3	cool microclimate (DMCF)
Greene milkweed	*Asclepias uncialis* spp. *uncialis*	S	F?	MPOW, GBG
crenulate moonwort	*Botrychium crenulatum*		F?	SFF
White Mountains paintbrush	*Castilleja mogollonica*	S	F2	WMCF (meadows), SFF (meadows)
Mexican hemlock parsley	*Conioselinum mexicanum*		F2	cool microclimate (MPOW)
yellow lady's slipper	*Cypripedium parviflorum* var. *pubescens*	S	F1	collection (WMCF, SFF)
Arizona sneezeweed	*Helenium arizonicum*	S	F2	wet meadow (PPF)
Arizona sunflower	*Helianthus arizonensis*	S	F1	mosaic of conditions (GBG, SDG)
Eastwood alumroot	*Heuchera eastwoodiae*	S	F1	canyon slopes
Arizona alumroot	*Heuchera glomerulata*	S	F3	canyon slopes
wood nymph	*Moneses uniflora*		F3	WMCF, SFF
heathleaf (bittercress) ragwort	*Packera cardamine*	S	F3	wet meadow, shaded forest opening, (WMCF, SFF)

FPS by	Species Group	Status[a]	F Ranking[b]	PNVT Habitat Element[c]
superb penstemon	*Penstemon superbus*		F2	MPOW, SDG
yellow Jacob's ladder	*Polemonium foliosissimum* var. *flavum*		F2	collection (WMCF, SFF)
Davidson's cliff carrot	*Pteryxia davidsonii*	S	F1	cliffs, canyon slopes
Parish alkali grass	*Puccinellia parishii*	S	F1	wet alkali swales (GBG)
Blumer's dock	*Rumex orthoneurus*	S	F3	water quality, healthy riparian conditions
Arizona willow	*Salix arizonica*	S	F1	healthy riparian conditions
Bebb willow	*Salix bebbiana*	S	F3	healthy riparian conditions
hooded lady's tresses	*Spiranthes romanzoffiana*		F2	collection (WMCF, SFF)
splachnoid dung moss	*Tayloria splachnoides*		F2	MSG
Mogollon clover	*Trifolium neurophyllum*	S	F3	wet meadow, shaded forest opening (PPF)
Oak Creek triteleia	*Triteleia lemmoniae*		F3	shaded forest opening (PPF)
carnivorous bladderwort	*Utricularia macrorhiza*		F1	water quality

[a] Status: T = ESA threatened; E = ESA endangered; ENE = ESA experimental, nonessential; CH = ESA critical habitat; p = ESA proposed; C = ESA candidate for listing under ESA; S = Southwestern Region sensitive species; HI = highly interactive species (see the following section).

[b] F ranking (existing condition relative to reference or desired conditions): F? = unknown abundance/distribution, F1 = extremely rare, F2 = rare, F3 = uncommon (including locally common but in rare locations), F4 = widespread, F5 = secure

[c] Parentheses ( ) notes where a habitat element is tied to a particular PNVT, otherwise the habitat element generally occurs irrespective of PNVT(s).

[d] Initially, the Mexican spotted owl was widespread in suitable habitat across the planning unit; the Wallow Fire affected habitat suitability substantially and there is uncertainty about their persistence so that their F ranking is adjusted to F3. Post-fire MSO surveys began in 2012.

[e] Currently recognized as *Lycaena rubidus ferrisi*.

Endangered Species Act Species and Critical Habitat

Existing abundance and distribution (F ranking) of the 10 ESA species included as FPS is shown in table 71 above. Due to their status as endangered with extinction or threatened with endangerment (ESA section 3(6) and (20)), viability is a concern and all are ranked F1. Suitable ESA species habitat identified below is considered quality habitat in that it contains the components necessary to support successful reproduction, young rearing, and species persistence (i.e., viability).

The amount (acreage) of habitat for each ESA species provided by their associated PNVT(s) is found in affected environment of the “Vegetation” section (table 23) so is not reiterated here. The existing condition of each PNVT (i.e., the quality of that habitat described in terms of departure from desired conditions) is also found the in the affected environment of the “Vegetation” section. Additional information about the species, critical habitat (if designated under ESA), and habitat occupancy follows. For more detail, see the biological and conference opinion for the continued implementation of the Apache-Sitgreaves NFs land and resource management plan (USFWS, 2012a) and the “Wildlife Specialist Report – Biological Assessment” (Forest Service, 2014z). Note that each ESA species can have a different focus for recovery so that terminology for each can be different (e.g., management unit or recovery unit).

Mexican Spotted Owl: Threatened with Critical Habitat

Population, i.e., breeding population, information for the Mexican spotted owl (MSO) is found in the following ”Management Indicator Species” section. Threats to the species include stand-replacing fires and past silviculture treatments. Improper livestock grazing impacts prey habitat while land and water developments reduce habitat. Roads and special uses can disturb nesting MSO. General habitat information follows; however, details about MSO habitat components are found in the “Mexican Spotted Owl Recovery Plan” and the “Wildlife Specialist Report – Biological Assessment” (Forest Service, 2014z).

Habitat for MSO is provided by various forested PNVTs: dry mixed conifer, wet mixed conifer, spruce-fir, the pine-oak portion (approximately 30 percent) of ponderosa pine, a portion of Madrean pine-oak woodland, and the three riparian forested PNVTs. Table 72 provides the amount of acreage in these PNVTs, or portions thereof, along with the amount of acreage that remains suitable after the 2011 Wallow Fire. These compose MSO restricted habitat on the forests but also include protected habitat (see paragraph below). Restricted habitat is managed to maintain and develop potential nesting and roosting habitat now and into the future (USFWS, 1995).

Protected areas provide MSO breeding and young rearing habitat. It includes protected activity centers (PACs), other steep slopes (greater than 40 percent not harvested in 20 years), and reserved areas (e.g., wilderness or primitive area). On the Apache-Sitgreaves NFs, there are 147 MSO PACs delineated around nesting and roosting sites of no less than 600 acres each. These PACs encompass 93,117 acres[30]. All MSO protected and restricted habitat on the forests is considered occupied or potentially occupied, especially after the Wallow Fire because it is unknown how MSO would adjust habitat use after this landscape scale fire.

[30] In order to delineate logical PAC boundaries, PAC acreage sometimes include small acreages in PNVTs not listed here, e.g., ponderosa pine without oak or wetland/cienega riparian areas. In addition, four PACs fall partially outside the Apache-Sitgreaves NFs onto other forests (three on the Coconino NF and one on the Gila NF), encompassing about an additional 568 acres.

Table 72. MSO habitat by PNVT and existing condition, noting estimated change in suitable habitat acres from the 2011 Wallow Fire

MSO Habitat by PNVT and Acreage	Proportion of Habitat with 100% Basal Area (canopy cover) Loss from the 2011 Wallow Fire[a] (% loss of PNVT acres)	MSO Habitat by PNVT Adjusted for the Loss of Total Basal Area from the Wallow Fire (100% of canopy cover loss)[b] = Remaining Currently Suitable MSO Habitat
Dry mixed conifer 147,885 acres	34,959 acres (24%)	112,926 acres
Wet mixed conifer 177,995 acres	64,794 acres (36%)	113,201 acres
Spruce-fir[c] 17,667 acres	6,098 acres (35%)	11,569 acres
Pine-oak portion of ponderosa pine 90,336 acres[d]	22,584 acres (25%)[e]	estimated as 67,752 acres
North and northeast slopes of Madrean pine-oak woodland 42,903 acres[e]	6,864 acres (16%)[f]	estimated as 36,039 acres
Mixed broadleaf deciduous, cottonwood-riparian, and montane willow riparian forests 30,341 acres	1,142 acres (4%)	29,199 acres
Total 507,127 acres	estimated as 136,441 acres (27% habitat loss overall)	estimated as 370,686 acres

[a] Figures are from the 75-100% BA loss category which reflects complete (100%) loss of all trees based on the 7/18/11 RVAG mapping provided by USFS Remote Sensing Applications Center.

[b] These figures represent currently suitable MSO habitat. Recovery to the forest structure and age needed by MSO for breeding and nesting extend beyond the planning period and a century or more, the adjusted acreage is considered suitable (quality) MSO habitat acreage across the forests for the planning period.

[c] Note that the spruce-fir PNVT on the Apache-Sitgreaves NFs meets the definition of “mixed conifer” in the 2012 MSO Recovery Plan.

[d] Based on forest inventory analysis, this figure represents the amount of medium to large size ponderosa pine with closed canopies and Gambel oak (90,336 is approximately 30 percent of mid-scale states H, I, L, M).

[e] This acreage represents Madrean pine-oak woodland on slopes >40 percent with a north and northeast aspect.

[f] Not specifically determinable because the actual spatial occurrence of pine-oak within ponderosa pine and Madrean pine-oak that is suitable as MSO habitat is not available at the forest planning mid-scale level; however, it is estimated as noted above at 25 percent of all ponderosa pine forest acreage and 16 percent of Madrean pine-oak woodland acreage on slopes with north and northeast aspects.

The ESA directs that critical habitat be identified for listed species. For the Mexican spotted owl, critical habitat consists of acreage that qualifies as protected and restricted habitat (as defined in the “Mexican Spotted Owl Recovery Plan”) within the bounds of the broad 2004 USFWS MSO critical habitat delineation. The primary constituent elements of critical habitat that are important for breeding, young rearing, and foraging include large trees and snags, high basal areas and canopy closures, large volume of woody debris, and herbaceous plant cover and seeds for prey. Critical habitat is estimated for this analysis as shown in table 73, along with the amount of acreage that remains suitable after the Wallow Fire. Note that these estimates have not been field verified; this would be done on a project-specific basis.

Table 73. MSO critical habitat by PNVT and existing condition, noting estimated change in suitable critical habitat acres from the 2011 Wallow Fire

MSO Habitat by PNVT and Acreage[a]	PNVT Acres as Critical Habitat-Protected and Restricted[b]	Critical Habitat (CH) Acres with 100% BA Loss (% of total critical habitat acres in Wallow Fire)	Critical Habitat Acres Adjusted for the Loss of Total Basal Area from the Wallow Fire (100% of canopy cover loss) = Remaining Currently Suitable MSO Critical Habitat
Dry mixed conifer 147,885 acres	132,681 acres	31,914 acres (52%)	100,767 acres
Wet mixed conifer 177,995 acres	154,679 acres	61,798 acres (81%)	92,881 acres
Spruce-fir 17,667 acres	12,549 acres	6,059 acres (97%)	6,490 acres
Pine-oak portion of ponderosa pine 90,336 acres[c]	27,1002 acres[d]	estimated as 6,775 acres (25%)[e]	20,325 acres
North and northeast slopes of Madrean pine-oak woodland 42,903 acres	14,797 acres	estimated as 631 acres (16%)[e]	14,166 acres
Mixed broadleaf deciduous, cottonwood-riparian, and montane willow riparian forests 30,341 acres	12,339 acres	4,638 acres (38%)	7,701 acres
Total 507,127 acres	345,145 acres	111,815 acres (32% CH loss overall)	242,330 acres

[a] PNVT acreage from table 72 previously.

[b] Based on USFWS, 2004.

[c] See the column footnotes from table 72 previously.

[d] Not specifically determinable because the actual spatial occurrence of pine-oak within ponderosa pine is not available at the forest planning level scale; however, it is estimated based on forest inventory analysis showing about 30 percent of ponderosa pine is pine-oak and assuming 30 percent falls within the 2004 USFWS critical habitat designation.

[e] Estimated at 25 percent and 16 percent as noted in footnote e from table 72 previously.

Southwestern Willow Flycatcher: Endangered with Critical Habitat

Southwestern willow flycatchers (SWWF) nest within two recovery management units (MUs) on the forests: the Little Colorado River and the San Francisco River. The number of SWWF territories, based on monitoring between 1993 and 2007, ranged from 2 to 14. While the number of territories appears to be generally declining over time, consistent surveys have not been conducted since 2007. Threats to the species include ungulate grazing, loss of surface and subsurface water (from pumping, drought, climate change), and nest parasitism by brown-headed cowbirds.

The Greer, River Reservoir, and Alpine nesting sites are found within the montane willow riparian forest PNVT where existing conditions at these sites consist of tall, dense, expansive stands of primarily Geyer's willow and slow moving or standing water for insect prey. While flycatchers need extensive willow structure density and depth for nesting, they do migrate along stream corridors where willow cover is not as well developed or has been reduced due to wild ungulate browsing. As such, in addition to the three known nesting sites, all of this PNVT is considered occupied or potentially occupied for at least a portion of the year. In total, there are 4,808 acres of montane willow riparian forest PNVT.

All three nesting sites are excluded from livestock grazing with the Alpine site additionally protected from browsing by wild ungulates. Another potential nesting site, Nutrioso Wetland above Nelson Reservoir, is also protected from all ungulate use in order to allow willows there to expand in stature and width. Wild ungulate use is limited at the Greer and River Reservoir sites because they are within the Greer community. None of these sites were directly affected by the Wallow Fire, nor subsequently indirectly impacted by heavy flooding to date.

Since the publication of the DEIS, revised critical habitat has been finalized and designated for the Southwestern willow flycatcher. On the forests, it would include three areas: portions of the Little Colorado River and the West Fork Little Colorado River for a total of 12.5 river miles and 344 acres (includes the two Greer area nest sites); portion of the San Francisco River in the vicinity of Alpine for a total of 6.3 river miles and 311 acres (includes the Alpine nest site); and another portion of the San Francisco River, all on the Clifton Ranger District for a total of 22.6 river miles and 1,418 acres.

The primary constituent elements of critical habitat that are important for breeding, dispersing, and migrating SWWF include dense riparian vegetation with small openings and slow moving water attracting insect prey populations. The Wallow Fire impacted watershed containing critical habitat, especially within the West Fork Little Colorado River canyon where it resulted in low to high severity.

Western Yellow-billed cuckoo: Proposed Threatened

Since publication of the DEIS, the western yellow-billed cuckoo has been proposed for listing under the ESA as threatened. While there have been no systematic surveys for this species by the forests, it is known from upper and lower Blue River, San Francisco, and Eagle Creek. Other rivers and floodplains may provide the shelter and cover needed along movement corridors between foraging sites and as post-breeding dispersal areas for adults and young. These perennial streams contain the mixed broadleaf deciduous riparian forest PNVT that provides large riparian trees such as cottonwood, willows, and boxelder with dense canopies for nesting and for foraging of large insect and other prey such as frogs. The 2011 Wallow Fire did not substantially affect habitat in the Blue River.

Threats to the species include features or actions that impact natural water flows (e.g., dams, ditches, ground water pumping, bank stabilization features, channel work, roads), development or extraction within floodplains (e.g., gravel pits), expansion of nonnative vegetation within streams and floodplains, and livestock grazing that impacts woody riparian vegetation and its regeneration. Water diversions, groundwater pumping, and roads occur on NFS lands primarily, but not solely, along Eagle Creek. Livestock grazing is not currently authorized along these three waterways although livestock trailing is authorized along Eagle Creek.

Since the publication of the DEIS, critical habitat has been proposed for this species. The primary constituent habitat elements that are important for breeding, young rearing, and movement include riparian woodlands with high canopy closures of the woody riparian species noted above where the cuckoo is found on the forests. Another primary constituent element is the presence of a large insect fauna (e.g., cicadas, caterpillars, grasshoppers, large beetles, and dragonflies) and tree frogs and the vegetation and water that support these. Dynamic riverine processes are another primary constituent element; hydrologic processes are functions such as sediment movement and deposition that allow seedling germination and growth, elevated groundwater tables, and perennial water that support continuous regeneration and multiple age classes of vigorous riparian vegetation.

Chiricahua Leopard Frog: Threatened with Critical Habitat

The Chiricahua leopard frog is found on the Apache-Sitgreaves NFs in pools along streams, creeks, wetland cienegas, and springs. It was historically found in larger rivers and bodies of water like Chevelon Creek and Nelson Reservoir. Currently the species is being captive reared in facilities in Phoenix and Pinetop. Since 2000, a number of new or supplemental frog releases have occurred on the Alpine and Springerville Ranger Districts including recently in two isolated stock tanks on the ridge above Three Forks. Threats to the species include poor water quality, disease, drought and climate change, and loud noises that interrupt the advertisement call of the Chiricahua leopard frog during breeding season.

This species is currently found in two watersheds on the forests. The Upper Black River watershed was functioning-at-risk prior to the Wallow Fire. Based on the post-fire hydrology report, approximately 2,700 acres burned moderately to severely above the Three Forks area (North Fork East Fork Black River subwatershed). The Campbell Blue watershed was in proper functioning condition prior to the fire, but about 18,400 acres burned moderately to severely (Campbell Blue and Coleman Creek subwatersheds). Although post-fire stream surveys have not yet been conducted, the conditions of Campbell Blue Creek and Coleman Creek have declined.

There are four Chiricahua leopard frog recovery units (RUs) that fall partially on the forests. Recovery is concentrated on the two RUs on the east side of the forests: White Mountains-Upper Gila (RU 6) encompassing forests lands above the Mogollon Rim and the Upper Gila-Blue River (RU 7) encompassing lands below the rim (both extend into New Mexico). RUs contain recovery management areas (RMAs) which are designated because they have the greatest potential for successful recovery actions and threat alleviation.

RMAs are as follows, including subwatershed acreage on the forests; however, not all acreage within a RMA provides suitable habitat for this species but would contribute to indirect effects. RU 6 contains three RMAs: Black River (185,900 acres), Coleman Creek/Blue River (179,900 acres), and Nutrioso/Rudd Creek (105,400 acres). RU 7 contains one RMA, San Francisco/Blue Rivers (77,500 acres).

Within each RMA, there are recovery sites where metapopulations and robust, isolated populations occur or will be established. For this analysis, all of these sites are considered occupied given that surveys do not guarantee detection and that continuing releases are planned by the AZGFD. All historic sites (1928–1999) are considered suitable habitat but are unoccupied at this time. Dispersal and nonbreeding habitat provides corridors for frogs between breeding sites. It consists of (1) areas with ephemeral, intermittent, or perennial water not generally suitable for breeding and (2) associated upland or riparian habitat. These areas are considered potentially occupied habitat for at least part of the year (USFWS, 2012a).

Critical habitat for the Chiricahua leopard frog is found in five critical habitat units (CHUs). All are occupied and in total encompass approximately 270 acres. In RU 6, the CHUs are (1) Concho Bill and Deer Creek and (2) Campbell Blue and Coleman Creek. In RU 7, the CHUs are (3) Left Prong Dix Creek, (4) Rattlesnake Pasture and Tanks, and (5) Coal Creek. Primary constituent elements of critical habitat important to breeding and dispersal include fresh water, emergent/submerged vegetation, and well distributed ephemeral or intermittent drainage dispersal corridors free of barriers.

Based on the post-fire hydrology report, the Wallow Fire impacted subwatersheds containing the two CHUs in RU 6 where it burned approximately 32,600 acres at the high and moderate soil burn severity levels. This includes the three management areas within RU 6 (Black River, Coleman Creek/Blue River, and Nutrioso/Rudd Creeks). It did not impact any CHUs in RU 7 nor its one RMA (San Francisco/Blue Rivers). Besides uncharacteristic wildfires, risks to this species include impacts to water quality, die-offs due to a fungal skin disease (*Chytridiomycosis*), and predation by nonnative organisms (crayfish).

Narrow-headed Gartersnake: Threatened with Proposed Critical Habitat

Northern Mexican Gartersnake: Threatened with Proposed Critical Habitat

Since publication of the DEIS, the narrow-headed and northern Mexican gartersnakes have been listed as threatened species with proposed critical habitat. The first record of NMGS on the ASNFs occurred on Campbell Blue Creek in 2000 when four snakes were found. In 2007, a total of eight NMGS were located on the Blue River, near Juan Miller Road and near its confluence with Campbell Blue Creek. In 2009, one NMGS was located on the Blue River at its confluence with Campbell Blue Creek.

The 2011 Wallow Fire resulted in siltation of habitat and a decrease in fish prey species, but prey are rebounding based on observation and preliminary survey by Forest Service and AZGFD biologist. In addition, native sucker and dace populations that provide gartersnake prey appear to be recovering post Wallow Fire in the Blue and Black Rivers. Other threats to these two gartersnakes include nonnative species such as crayfish and nonnative spiny-rayed fish, roads and livestock that impact riparian areas (e.g., sediment, trampling), and drought and climate change.

Critical habitat for the northern Mexican gartersnake is proposed on the main Black River. For the narrow-headed gartersnake, critical habitat is also proposed on the main Black River and also along Eagle and Campbell Blue Creeks, and the Blue and San Francisco Rivers. Proposed critical habitat includes consideration of adequate terrestrial space of 600 feet (182.9 m) lateral extent to either side of bankfull stage important to support life functions. Primary constituent elements of proposed critical habitat include aquatic habitat that provides foraging opportunities for native fish and amphibians and shoreline or floodplain components that include rocks, woody debris, leaf litter, and small mammal holes that support thermoregulation, gestation, shelter, and protection from predators

Three Forks Springsnail: Endangered with Critical Habitat

The Three Forks springsnail is a tiny freshwater spiral-shelled invertebrate known only from the Alpine Ranger District, originally from three sites in the Black River watershed. Its habitat is very rare consisting of springheads and associated rheocrene flows (shallow spring water outflow) often associated with fens (upwelling of groundwater not likely associated with the immediate water table). Since 2004, the snail is not currently found at the Three Forks site but is found at nearby Boneyard Bog and along Boneyard Creek sites. Because a thorough inventory of springs in the Black River watershed has not been conducted, any spring of this type within the watershed is considered suitable and potentially occupied.

This species is found in the Upper Black River watershed which was functioning-at-risk prior to the 2011 Wallow Fire. Based on the post-fire hydrology report, approximately 2,700 acres burned moderately to severely above the Three Forks area (North Fork East Fork Black River subwatershed). Although post-fire stream surveys have not yet been conducted, the condition of the East Fork Black River, Boneyard Creek, and their tributaries may have declined.

Other threats to the species include vegetation trampling and soil sediment. All three locations are excluded from livestock grazing by NEPA decision and the Three Forks site is additionally excluded from human entry by a forest special closure order. However, all sites are subject to wild ungulate impacts (specifically, seasonal elk wallowing and bank trampling). Populations are additionally threatened by uncharacteristic wildfires, predatory crayfish, drought, and climate change. Crayfish trapping has been conducted for several years but they persist at all sites.

While the 2011 Wallow Fire did not directly burn snail habitat, straw waddles were installed to divert ash on adjacent burned slopes from entering the sites. In addition, Three Forks springsnails were removed prior to post-fire flooding and taken to facilities in Phoenix and Pinetop for later return to the spring runs where they were removed from. Flooding from 2011 summer rains after the fire resulted in several of the occupied spring runs in Boneyard Bog and Boneyard Creek being overrun by high flows. September 2012 surveys only observed snails at a few of the spring runs that had been occupied before the fire. The ability of those snails onsite to persist and the success of subsequent reintroduction of snails removed prior to flooding are unknown.

Critical habitat for this springsnail is designated at three sites: Three Forks (6 acres), Boneyard Bog (5.3 acres), and Boneyard Creek (5.8 acres along approximately 0.6 mile of creek). Primary constituent elements of critical habitat include adequately clean, emerging spring water (free from contamination) and flowing across the surface; substrates that include cobble, gravel, pebble, and aquatic vegetation (periphyton, attached algae) for feeding and escape from predators; and either an absence of nonnative predators (crayfish) or their presence at low population levels.

Mexican Wolf: Experimental, Nonessential Population

The Mexican wolf (or Mexican gray wolf) was reintroduced onto the Apache-Sitgreaves NFs in 1998. Over 655,000 acres of primary recovery area and 543,000 acres of secondary recovery area are on the Apache side of the forests, all of which is considered suitable habitat. Additional secondary recovery area is located on the adjacent Gila National Forest. Given the far ranging nature of this species, all acreage within the primary and secondary recovery areas is considered potentially occupied and used by Mexican wolves.

As of winter 2011-12, there are five wolf packs with established territories on the Apache-Sitgreaves NFs, ranging in size from two to five individuals. Two of these packs also use areas on the White Mountain and San Carlos Indian Reservations. Wolves are habitat generalists, occurring wherever prey are seasonally found. In a diet study on the forests, Reed et al. (2006) found that elk make up the majority (77 percent) of their diet biomass, reflecting availability of their most common prey species. It has been found that wolves are at risk from roads and open visibility that exposes them to danger from vehicle collisions and shootings. These types of mortality account for 65 percent of known wolf mortality since reintroduction (USFWS, 2011). It is not known if the extensive loss of mid to low ground cover across the landscape from the Wallow Fire may contribute to this risk.-Other threats to the species include vehicle-related deaths and concerns about the inadequacy of the size of the Blue Range Wolf Recovery Area.

New Mexico Meadow Jumping Mouse: Endangered with Proposed Critical Habitat

Since publication of the DEIS, the New Mexico meadow jumping mouse has been listed as endangered with proposed critical habitat. As of surveys in 2008 and 2009, there are 12 know occupied sites within the boundaries of the Alpine and Springerville Ranger Districts. One of the sites is on AZGFD property and one site is on private land that may be exchanged into NFS ownership. All of the sites are in the montane willow riparian forest PNVT with elements of the wetland-cienega PNVT, except one that is in the cottonwood-willow riparian forest PNVT.

Threats to the species include uncharacteristic wildfire. Fire severity from the 2011 Wallow Fire in the watersheds containing the New Mexico meadow jumping mouse ranged from low to severe but post fire flooding has been substantial at primarily one site, Campbell Blue Creek. Other threats include roads, water developments, and recreation in riparian areas.

Critical habitat for the New Mexico meadow jumping mouse is proposed in the East and West Forks of the Little Colorado River, East and West Forks of the Black River, Centerfire and Boggy Creeks, Nutrioso Creek, San Francisco River (in the Alpine valley), Campbell Blue Creek, and Corduroy Creek. Proposed critical habitat includes consideration sufficient areas of up to 15 miles along streams to support dispersal, and adjacent floodplain and upland areas approximately 330 feet outward from the water’s edge are necessary for young rearing and hibernation. Primary constituent elements of proposed critical habitat in these areas include flowing water, saturated soils, and dense, tall riparian herbaceous species to support foraging and nesting and adjacent likely adjacent uplands for its extended hibernation period.

Lesser Long-Nosed Bat: Endangered

The closest known location for the lesser long-nosed bat, a long distance migrant, is in the Pinaleno Mountains about 30 air miles from the forests’ southern boundary. This species is not known to be present in Arizona in the winter, but pregnant females give birth and raise young in southern Arizona during late April to July. The lesser long-nosed bat forages on nectar and pollen of columnar cacti in the spring; while in the summer and fall it forages on agave nectar (this diet of nectar enables it to be essentially independent of free water). This species roosts in caves, mine holes, and sometimes old structures. Threats to the species include loss of agave forage plants through fires or grazing of agave flowering stalks, which are highly palatable to livestock.

While not known to occur, lesser long-nosed bats could be present on the lower elevations of the forests during the summer below the Mogollon Rim given the potential for warming climates. This east-central portion of Arizona includes the East Eagle Creek, Blue River, and San Francisco River watersheds on the Clifton and Alpine Ranger Districts. Here, two PNVTs could potentially provide suitable foraging habitat: semi-desert grassland (106,952 acres) and Madrean pine-oak woodland (394,927 acres). In addition, this area contains some old structures, mine adits, and shallow caves. There is a 90-day finding that downlisting the lesser long-nosed bat to threatened status is warranted by pending.

Sensitive Species Existing Condition and Habitat

Existing abundance and distribution (F ranking) of the 53 sensitive species is shown in table 71 above; most are F1, F2, or F3. This is because sensitive species, by definition (Forest Service Manual 2670.32), are those for which there may be a viability concern.

The amount (acreage) of habitat for each sensitive species that is provided by PNVT(s) is found in affected environment of the “Vegetation” section (table 23) so is not reiterated here. The existing condition or the quality of that habitat is described in terms of departure from PNVT desired conditions is also found in affected environment of the “Vegetation” section. The general condition of habitat elements associated with sensitive species is found in table 67 above. There are few extensive forestwide surveys for sensitive species; surveys are instead conducted on a project- or district-level basis. For this analysis, all PNVTs and habitat elements for sensitive species are considered occupied or potentially occupied. For more information, see the “Wildlife Specialist Report – Biological Evaluation” (Forest Service, 2014aa).

Management Indicator Species and Indicator Habitat Existing Conditions

In compliance with NFMA, three species are selected as management indicator species (MIS) because they have habitats influenced by forest management and activities. They are selected so that the effects of each alternative on wildlife populations can be estimated. The ponderosa pine, dry mixed conifer, and wet mixed conifer are forested PNVTs where substantial restoration efforts would take place to move habitat toward desired conditions (up to 55,000 acres per year). MIS selected for these two PNVTs are the northern goshawk and Mexican spotted owl, respectively. In addition, the Great Basin grassland is another PNVT where substantial restoration would take place (up to 25,000 acres per year); pronghorn antelope are selected as MIS for this PNVT. See the “Report on the Selection of Management Indicator Species and Ecological Indicators” (Forest Service, 2012d) for more details on the selection process and further rationale.

Existing condition for these three indicators is described below. Much of the information is based on the Apache-Sitgreaves NFs’ 2005–2011 MIS assessment report (AZGFD, 2012) and the biological assessment for the Wallow Fire emergency response (Forest Service, 2011d). Suitable habitat noted below is considered quality habitat in that it contains the components necessary to support successful reproduction and young rearing.

Mexican Spotted Owl (MSO)

In addition to being a threatened species under ESA, the MSO is selected as a MIS. Population figures for MSO on the planning unit are not available. Because MSO protected activity centers (PACs) represent breeding or potentially breeding pairs, the number of PACs is used as a measure of the population of this MIS. There are 147 MSO PACs, encompassing 93,117 acres. The 2011 Wallow Fire affected half of the PACs (74) on the forests to varying degrees so that population trend is considered downward. Monitoring of PACs occurred during the 2012 field season to assess the fire’s impact to Mexican spotted owls and is ongoing. In 2013, the Rocky Mountain Forest and Range Experiment Station began studying MSO site fidelity after large fires (e.g., Rodeo-Chediski and Wallow Fires).

Of the various PNVTs, or portions thereof that provide MSO habitat, it is the dry mixed conifer and wet mixed conifer PNVTs together that provide the most important MSO habitat relative to reproduction and viability. Therefore, both PNVTs are considered the "indicator habitat" for this management indicator species. Table 74 shows the acreage of indicator habitat both before and after the 2011 Wallow Fire.

Table 74. Indicator habitat (PNVTs) for MSO showing existing condition and noting estimated change in suitable habitat acres from the 2011 Wallow Fire

MIS Habitat Indicator PNVTs for MSO and PNVT Acreage	Proportion of Habitat with 100% Basal Area (canopy cover) Loss from the 2011 Wallow Fire[a] (% loss of PNVT acres)	Acreage Adjusted by the Loss of Total Basal Area (100% of canopy cover loss)[b] = Remaining Currently Suitable MSO Habitat
Dry Mixed Conifer 147,885 acres	34,959 acres (24%)	112,926 acres
Wet Mixed Conifer 177,995 acres	64,794 acres (36%)	113,201 acres
Total 325,021 acres	99,753 acres (31% overall)	226,127 acres

[a] Figures are from the 75-100% basal area loss category which reflects complete (100%) loss of all trees and canopy based on the RVAG mapping provided by USFS Remote Sensing Applications Center (July 18, 2011).

[b] Recovery to the forest structure and age needed by MSO for breeding and nesting in such burn areas extends beyond the planning period and a century or more; the adjusted acreage is considered suitable MSO habitat acreage across the forests for the planning period.

Overall, 31 percent of the indicator habitat sustained total canopy loss (i.e., 75 to 100 percent basal area loss) from the Wallow Fire. This has substantially reduced suitable habitat for breeding, nesting, and young rearing. Hence, MSO habitat trend on the forests is now considered downward.

Northern Goshawk (NOGO)

Population figures for NOGO on the planning unit are not available. Because NOGO post-fledging areas (PFAs) represent breeding or potentially breeding pairs, nest area habitat within PFAs is used as a measure of the population of this MIS. There are 103 NOGO PFAs encompassing 67,466 acres of which approximately 18,540 acres are considered suitable nesting habitat based on nest stands. The 2011 Wallow Fire affected 30 of these PFAs. Approximately half of the acreage in these 30 PFAs had 100 percent canopy loss so that population trend on the forests is now considered downward. Monitoring of PFAs occurred during the 2012 field season to assess the fire's impact to northern goshawks over time and is ongoing.

The ponderosa pine PNVT is the most important NOGO habitat relative to reproduction and viability so it is considered the "indicator habitat" for this management indicator species. Table 75 depicts the acreage of indicator habitat both before and after the 2011 Wallow Fire.

Table 75. Indicator habitat for northern goshawk showing existing condition and noting estimated change in habitat acres from the 2011 Wallow Fire

MIS Habitat Indicator PNVTs for NOGO and PNVT Acres on ASNFs	Proportion of NOGO Habitat with 100% Basal Area (canopy cover) Loss from the 2011 Wallow Fire[a] (% loss of PNVT acres)	Acreage Adjusted by the Loss of Total Basal Area (100% of canopy cover loss)[b]
Ponderosa pine 602,206 acres	32,722 acres (5%)	569,484 acres

[a] Figures are from the 75-100% basal area loss category which reflects complete (100%) loss of all trees and canopy based on the RVAG mapping provided by USFS Remote Sensing Applications Center (July 18, 2011).

[b] Recovery to the forest structure and age needed by NOGO for breeding and nesting in such burn areas extends beyond the planning period and a century or more, the adjusted acreage is considered suitable NOGO habitat acreage across the forests for the planning period.

Although only 5 percent of the indicator ponderosa pine habitat sustained total canopy loss from the Wallow Fire, trend was considered downward pre-fire based on monitoring of PFAs from 2006 through 2011 across the forests. This is believed to be, in part, due to drought over the last decade that has led to the loss of habitat conditions necessary for many NOGO prey species (AZGFD, 2012). Post-Wallow Fire, the trend is still considered downward based on PFA acreage with 100 percent canopy loss.

Pronghorn Antelope (Pronghorn)

Pronghorn are a common and persistent species on the Apache-Sitgreaves NFs, although limited in number (AZGFD, 2012). While they occur at densities less than habitat capacity, they are well distributed in areas across suitable habitat. Overall, population trend is considered static with approximately 600 to 700 pronghorn on the Apache-Sitgreaves NFs portion of game management units 1, 3A, and 3B in the last 2 years (AZGFD, 2012). Impacts to pronghorn from the Wallow Fire would be determined by AZGFD surveys in 2012 and beyond.

Most pronghorn on the forests are found in the Great Basin grassland PNVT (185,523 acres). Although numbers are limited, pronghorn also use the semi-desert grassland yearlong. Both of these PNVTs have substantial acreage where invaded tree densities are currently high. The montane-subalpine grassland PNVT is used in the summer by pronghorn. In addition, pronghorn are known to travel between grassland habitats through forest and piñon-juniper woodland areas with lower tree densities.

Because most pronghorn spend the greatest majority of their time yearlong in the Great Basin grassland, this PNVT is considered the “indicator habitat” for this MIS. Under existing conditions, pronghorn habitat in the Great Basin grassland is highly departed from desired conditions. Quality of habitat has been reduced by loss of extensive stands of desirable perennial grasses, forbs, and shrubs, and by encroachment by trees (primarily piñon and juniper). In addition, about two-thirds of the Great Basin grassland has been converted to a woodland type (“Vegetation Specialist Report,” Forest Service, 2014t). Given that pronghorn use some open wooded areas, it is estimated that, overall, about half of the Great Basin grassland acreage is today unsuitable pronghorn habitat, leaving about 92,762 acres as currently suitable “indicator habitat” for this management indicator species.

Fire can also benefit grasslands by removing encroaching trees and improving herbaceous production in healthy grasslands. The 2002 Rodeo-Chediski Fire and the 2011 Wallow Fire burned portions of the Great Basin grassland. However, limited acreage in both fires burned at an intensity to kill trees and restore habitat. The long-term trend in condition of grasslands in meeting the herbaceous needs of this species is dependent in part on the amount and timing of restocking burned areas with livestock post-fire and subsequent woody species regeneration (Belsky and Blumenthal, 1997; Forest Service, 2008f).

Over the last 10 years, tree removal projects have been initiated to begin to restore the Great Basin grassland across the north side of the forests (approximately 5,000 acres total completed to date). Although only affecting a small portion of this large PNVT, tree removal by project and wildfire, along with rest from livestock use post Rodeo-Chediski Fire, has taken place. In addition, about 200 miles of unneeded fence line has been removed on the forests during the last 10 to 15 years (mostly in grasslands), and roughly 300 miles of fence line has been modified or rebuilt to wildlife passage standards. While not all of this affects the over 700 miles of fence line in pronghorn grassland habitats, it does benefit pronghorn in areas where they encounter fences outside of grasslands. Hence, the trend for this pronghorn habitat indicator is currently considered on a low trajectory upward.

Migratory Birds and Important Bird Areas

Migratory Birds

Executive Order 13186 (2001) and a 2008 memorandum of understanding between the USDA Forest Service and USDI Fish and Wildlife Service provide direction to conserve migratory birds, restore or enhance habitat, and consider them in the planning process. The number of migratory birds on the forests is unknown; however, the White Mountain Audubon Chapter, local birders, and monitoring conducted as part of the White Mountain Stewardship have detected many species that use habitats on the Apache-Sitgreaves NFs for part of the year.

In selecting representative species for the analysis, Forest Service regional direction is to consider priority species of concern from Arizona's "Partners in Flight Conservation Plan" (Latta et al., 1999) and important bird areas (IBAs). Also used was the "Birds of Conservation Concern, Regions 16 and 34" (USFWS, 2008). Table 76 lists representative neotropical migratory birds and the PNVTs where they may be found while on the forests; it also lists threats to habitat. PNVT habitat acres are found in affected environment of the "Vegetation" section so are not reiterated here. The "Wildlife Specialist Report - Migratory Birds, Eagles, and Important Bird Areas" (Forest Service, 2014y) contains more information.

Table 76. Representative neotropical migratory birds considered, important habitat, and threats

Neotropical	Migrant	Habitat	Habitat Threats
Golden-crowned kinglet	*Regulis satrapa*	Spruce-fir (often with aspen)	Loss of or too open canopies
Three-toed woodpecker	*Picoides tridactylus*	Spruce-fir	Substantial snag removal or loss
Olive-side flycatcher	*Contopus borealis*	Mixed conifer (often with aspen)	Loss of or too open canopies
Purple martin	*Progne subis*	Ponderosa pine	Substantial snag and/or large tree removal or loss
Grace's warbler	*Dendroica graciae*	Ponderosa pine (often with aspen)	Loss of large Gambel oak
Flammulated owl	*Otus flammeolus*	Ponderosa pine with oak	Substantial snag, large tree and dense canopy removal or loss
Pinyon jay	*Gymnorhinus cyanocephalus*	Piñon-juniper woodland	Stress to or loss of mature piñon trees
Black-throated gray warbler	*Dendroica nigrescens*	Piñon-juniper woodland	Stress to or loss of mature piñon trees
Virginia's warbler	*Vermivora virginiae*	Interior chaparral	Widespread fire through chaparral
Gray flycatcher	*Empidonax wrightii*	Great Basin and semi-desert grasslands	Grazing that does not leave vigorous, tall herbaceous ground cover
Savannah sparrow	*Passerculus sandwichensis*	Montane/subalpine grassland	Grazing that does not leave vigorous, tall herbaceous ground cover
MacGillivray's warbler	*Oporornis tolmiei*	Montane willow riparian forest	Browsing that reduces height, depth, and vigor of willows
Yellow-breasted chat	*Icteria virens*	Mixed broadleaf riparian forest	Grazing or browsing that opens up dense riparian thickets increasing the threat of cowbird parasitism
Zone-tailed hawk	*Buteo albonotatus*	Large trees and/or dense canopies across PNVTs	Grazing or browsing that removes sprouts and young riparian woody vegetation

Little current forestwide information is available for these species. According to the forests' 2005–2011 MIS assessment report (AZGFD, 2012), yellow-breasted chat populations in the Apache-Sitgreaves NFs are currently considered to be stable, but likely lower than potential. At the mid-point of a long-term study of songbird densities within the White Mountain Stewardship Project area, there is an estimated average of five Grace's warblers per 100 acres in untreated ponderosa pine that has a Gambel oak component (Sitko and Hurteau, 2010). Because migratory bird numbers can be influenced by many factors associated with their neotropical wintering grounds, habitat provided on the forests is the focus of the analysis.

Important Bird Areas (IBAs)

While not contributing to viability directly, the National Audubon Society's Important Bird Area Program encourages inventory, research, and education with the objective of ensuring bird conservation in important habitats. IBAs impose neither management requirement nor legal obligation on NFS lands. Three IBAs are located in part on the Apache-Sitgreaves NFs.

- Upper Little Colorado River IBA — This IBA includes 44,086 acres on the forests encompassing the Little Colorado River and its three main tributaries (west, east, and south), extending north to include the AZGFD's Becker Lake and Wenima wildlife areas. This IBA was identified in 2004 and recognized by the State Audubon science committee in 2008. It is known for harboring species of conservation concern and species in rare/unique riparian habitats. These include southwestern willow flycatcher, Mexican spotted owl, northern goshawk, gray catbird, MacGillivray's warbler, and wintering bald eagles.
- Blue and San Francisco Rivers IBA — This IBA includes 108,576 acres on the forests encompassing approximately 40 miles of the Blue River, 10 miles of the Campbell Blue Creek, 5 miles of the KP Creek, and over 20 miles of the San Francisco River. Federal land within this IBA was identified in 2004 but it is not yet finalized by the State Audubon science committee. As of 2004, surveys have documented 216 bird species including Mexican spotted owl, northern goshawk, peregrine falcon, purple martin, juniper titmouse, yellow-breasted chat, common black-hawk, various flycatchers, and bald eagles.
- Mogollon Rim Snowmelt Draws IBA — This IBA includes 29,426 acres on the forests encompassing Leonard Canyon and Willow Creek; it extends westward to include additional acreage on the Coconino NF. This IBA was identified in 2010 but it is not yet finalized by the State Audubon science committee. Because of Mogollon Rim induced high moisture patterns, vegetation communities are more representative of high elevation forest types with associated species including Mexican spotted owl, olive-side flycatcher, and red-faced warbler. For over 25 years, a U.S. Geological Survey study of climate change impact to bird and plant communities has been conducted in the area of this IBA (Martin and Maron, 2012).

Bald and Golden Eagles

The bald eagle was delisted from threatened status across the State in 2010. Both the bald eagle and golden eagle are Regional Forester sensitive species and, with its abundant water, both occur on the Apache-Sitgreaves NFs.

Single and small groups of bald eagles are found on the forests during the fall through spring. They are seen foraging at reservoirs and larger rivers for fish and waterfowl. They also forage on hunter-loss game and roadkills along highways. There are two long-term nesting pairs of bald eagles located at Luna and Crescent Lakes. In addition, bald eagle nesting has occurred on the forests in the vicinity of Woods Canyon Lake, Greer Lakes, and Show Low Lake.

A major impact to nesting bald eagles is nearby heavy recreation use. All nest sites are near developed fishing, boating, or camping areas. In order to limit disturbance during the especially sensitive breeding and nesting period, the forests issue special closure orders that prohibit entry into bald eagle nest areas. Another factor in the success of breeding eagles has been the forests' long-term partnership with the Arizona Bald Eagle Nestwatcher Program. Nestwatcher vigilance and actions have helped promote eaglet fledgling success and have, thereby, contributed substantially to viability and the delisting of this species in Arizona.

While golden eagles occasionally nest on the forests, they are most often migrants observed during the fall through spring seasons feeding on carrion, small mammals, birds, and snakes. The attraction of this eagle and the bald eagle to roadkill and hunter loss makes both species vulnerable to collisions with vehicles and lead poisoning (one known case east of Luna Lake in 2002). Like other raptors and large birds, power line electrocution can occasionally occur, with the uncommon risk of igniting a wildfire.

Direction for management of golden and bald eagles is found in the Bald and Golden Eagle Act with its most recent amendment (2009), and the 2008 MOU noted above between the Forest Service and USFWS. Under the Eagle Act, the forests must determine if any management or action would result in "take" which includes "disturbance." In addition to immediate impacts, Federal Register (Vol. 72, No. 107, 31133) implementing the act amendment, notes that disturbance:

> also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding or sheltering habits and causes, or is likely to cause a loss of productivity or nest abandonment.

In these cases, a Federal permit for programmatic take of eagles or their nests is required.

Highly Interactive Forest Planning Species

The needs of far ranging species and their influence across large landscapes were an issue raised by the public during scoping. Six species are identified as highly interactive species (HI under status in table 71).

Highly interactive—or keystone or foundation species—are species whose absence or substantial reduction across the landscape leaves a functional void that, over time, can create changes leading to degraded or simplified ecosystems (Soulé et al., 2003). The ecological function of these species may take the form of altering habitat in a manner benefiting other species or in the form of affecting prey species, who may in turn affect habitat structure and function. In addition, for this analysis, species that range widely to meet their needs are also considered highly interactive species. Examples include the wolf and pronghorn antelope. The former can strengthen the health of prey herds by culling compromised animals (e.g., the old and weak) and help to keep herds actively moving, thereby preventing overuse of prey habitat areas (Beschta and Ripple, 2011). The latter is far ranging in order to meet seasonal needs for nutrition, fawning, and wintering areas (O'Gara and Yoakum, 2004).

Existing abundance and distribution (F ranking) of the six HI species is shown in table 71. Although considered a widespread species, existing habitat conditions for black bears have changed substantially due to the 2011 Wallow Fire and other large uncharacteristic wildfires with the loss of dense, low cover (critical to habitat carrying capacity and protection from other bears).

High debris and water flows after these fires washed out beaver ponds and associated habitat. While mountain lion are a secure species, prey species such as deer and elk are utilizing habitat in an entirely different manner after so much acreage was affected by the Wallow Fire. For existing condition information on the other three HI species (Mexican wolf, Gunnison's prairie dog, and pronghorn antelope), see the previous ESA, sensitive, and MIS sections, respectively.

Habitat Security and Connectivity and Wildlife Quiet Areas

Habitat security and connectivity along with the amount of wildlife quiet areas was an issue raised by public scoping. Initially, wildlife quiet areas (WQAs) alone, which are currently implemented via forest special order, were considered for habitat security and connectivity.

There are currently eight WQAs on the forests. There are three other areas, also in place by special order, that provide many of the benefits of WQAs, so these are additionally considered. Together these total less than 3 percent of the forests. Table 77 lists these along with the primary species associated with each.

Although these areas do not allow the use of motorized vehicles, they do *not* preclude hunting, other recreation activities, or periodic mechanized forest management activities. WQAs do *not* exclude motorized vehicles for emergency or activities authorized by permit such as public utilities, private water transmission lines, maintenance of developments, and livestock grazing. While existing WQAs have successfully provided secure habitat refugia and species site fidelity across the planning unit to date, there are large expanses without WQAs (up to 50 miles between them) on the Sitgreaves side of the forests. More background on WQAs is found in the "Wildlife Specialist Report – Viability" (Forest Service, 2014bb).

Table 77. Existing Wildlife Quiet Areas (WQAs) and other similar functioning areas

Name	Ranger District	Acres	Note	Species
WQAs Currently Under Special Order				
Beaver Turkey Ridge	Black Mesa	3,295	Long-term WQA	big game
Hulsey Bench	Alpine	3,469	Long-term WQA	deer, elk, turkey, black bear, MSO, NOGO
Middle Mountain	Alpine	3,629	Long-term WQA	deer, elk, turkey, pronghorn antelope, NOGO
Open Draw	Alpine	2,499	Long-term WQA	elk, deer, turkey
St. Peters Dome	Springerville	5,850	Long-term WQA	black bear, dusky grouse, wolves, other high elevation species
Upper Coyote	Alpine	829	Long-term WQA	elk, turkey, deer, black bear (especially young rearing)
Willow Springs-Horse Trap	Black Mesa	8,690	Long-term WQA	big game

Name	Ranger District	Acres	Note	Species
Woolhouse	Lakeside	17,245	Long-term WQA	Pronghorn antelope, elk (winter range)
Subtotal		45,506		
Other Areas Currently Functioning Similar to WQAs				
Carr Lake	Black Mesa	2,196	Currently within the larger Rim Lakes Recreation Area	big game, MSO
Palomino	Black Mesa	8,407	Currently within the larger Rim Lakes Recreation Area	big game, MSO
Hidden Lake	Springerville	3,227		deer, elk, black bear, NOGO
Subtotal		13,830		
Total Acres Functioning as WQA		**59,336**		

Safe passage among habitat areas is also important for species viability. In 2004, the AZGFD initiated a collaborative effort to proactively address wildlife connectivity with Arizona forests participating, including the Apache-Sitgreaves NFs. The objective of this effort is to facilitate wildlife movement, mitigate or remove barriers, and provide for or preserve known travel corridors. This is in response to increasing development of private lands, new and upgraded roadways, and increased fencing for livestock. An AZGFD report will be published that identifies linkages (common wildlife travel corridors) and barriers across Apache and Navajo Counties so that land managers can incorporate wildlife connectivity needs into project-level activities, as well as provide for both public and animal safety. This effort contributes to species viability across the forests.

Environmental Consequences of Alternatives

Wildlife and Rare Plants

This section evaluates and discloses the potential environmental consequences on wildlife and plants of implementing four plan alternatives. As previously noted, “wildlife” is inclusive of all terrestrial and aquatic animal species (including invertebrates) and plants. For potential environmental consequences to fish species, see the “Fisheries” section.

Alternative Differences, Similarities, and Outcomes

See the “Fisheries” section where alternatives are compared in the section under this same heading. Species viability and the consequences of plan implementation and activities are discussed in the following sections and, for non-fish species, include habitat and management effect findings. Also included are the consequences related to wildlife habitat security and connectivity. As noted under the “Fisheries” section, the analysis is based on high treatment objectives in order to capture all possible consequences

Non-fish Species Viability

As previously noted, the approach to assess species viability was twofold. Plan decisions (desired conditions and objectives) formed the initial or coarse filter step. Where these did not fully meet the needs of species, the fine filter step was included. It involved the development of additional plan decisions (standards and guidelines) that more fully addressed species needs or addressed short-term impacts from plan implementation (e.g., management or activities).

Alternative outcomes consist of viability risk ratings (based, in part, on the likelihood of habitat limitation) and management effect ratings. The number of viability risk ratings and the number of management effect ratings, by habitat element, are used to compare relative “viability effectiveness” among alternatives (i.e., the lower the alternative’s number of viability risk and management effect ratings for a species’ associated habitat element(s), the more effective the alternative is for that species’ viability). Therefore, environmental consequences for the 95 non-fish FPS, by alternative, are primarily expressed as having more or less “viability effectiveness” even though all alternatives provide species viability in compliance with NFMA. Viability risk and management effect ratings are also used to compare viability effectiveness consequences by alternative for ESA, sensitive, and other non-fish FPS.

Habitat and Management Effect Findings

The likelihood of habitat limitation, based on the estimate of future habitat abundance and distribution for each alternative, which is later coupled with species F ranking, is shown in table 78. The number of ratings for the three likelihood of limitation categories is summarized by PNVTs in order to provide an overall comparison of alternatives. Categories for the likelihood of limitation are described in table 64. These categories are low, moderate, and high (not to be confused with later viability risk rating categories). The lower the tally (number) of likelihood of limitation of low (L) ratings, the more effective the alternative is for that species’ viability.

The management effect is the overall expected outcome of alternative implementation in terms of species viability. The expected management effect outcomes for each alternative are the result of alternative objectives and maintenance of or movement toward desired conditions (suitable habitat). These are also shown in table 78 and are based, as noted, on high acre treatment objectives. The number of ratings for the three management effect categories is summarized by PNVT in order to provide an overall comparison of alternatives. Management effect categories are 1, 2, and 3. The lower the tally (number) of likelihood of management effect ratings for a species’ associated habitat, the more effective the alternative is for that species’ viability.

The management effect and the likelihood of limitation values displayed in this table each cover the 15-year planning period. Table 79 shows movement toward desired conditions for all the alternatives at the 15-year period and movement toward desired conditions at 50 years.

Table 78. Expected habitat limitations and management effect outcomes by alternative at 15 years

PNVT	A	B	C	D
Ponderosa Pine Forest				
Likelihood of limitation[a]	L	L	L	L
Management effect[b]	2	1	1	1
Dry Mixed Conifer Forest				
Likelihood of limitation[c]	M	L	L	L
Management effect	2	1	1	1
Wet Mixed Conifer Forest				
Likelihood of limitation [c]	M	L	L	L
Management effect	2	1	1	1
Spruce-Fir Forest				
Likelihood of limitation[c]	M	M	M	M
Management effect	2	2	2	1
Madrean Pine-Oak Woodland				
Likelihood of limitation	M	L	L	L
Management effect	2	1	2	1
Montane/Subalpine Grassland				
Likelihood of limitation	M	L	M	L
Management effect	3	1	3	1
Great Basin Grassland				
Likelihood of limitation	H	L	H	L
Management effect	3	1	3	1
Semi-Desert Grassland				
Likelihood of limitation	H	L	H	L
Management effect	3	1	3	1

PNVT	A	B	C	D
Tally of Likelihood of Habitat Limitation for PNVTs by Alternative				
L - low or no likelihood of habitat limitation:	0	7	4	7
M - moderate or some likelihood of habitat limitation:	5	1	2	1
H - high probability of habitat limitation:	3	0	2	0
Tally of Management Effects for PNVTs by Alternative				
1 - greatest relative improvement:	0	7	3	8
2 - intermediate relative improvement:	5	1	2	0
3 - least to no improvement:	3	0	3	0

Table rating descriptions or other information:

[a] Likelihood of limitation: H = high probability that habitat will be limiting; M = moderate or habitat has a likelihood of some limitation; L = low or habitat will not likely be limiting.

[b] Management effect: 1 = greatest relative improvement in suitable habitat through management and activities; 2 = intermediate relative improvement; 3 = least to no relative improvement.

[c] While dry mixed conifer, wet mixed conifer, and spruce-fir are still common across the forests, the 2011 Wallow Fire reduced suitable habitat by 24, 36 and 35 percent respectively; hence likelihood of limitation is increased one class.

Table 79 shows the movement toward desired conditions for the modeled PNVTs upon which the overall alternative management effect was based in the table above. Change in departure can be seen by comparing existing departure from desired conditions to departure at 15 and 50 years. The latter is a projection of trend in desired conditions should the alternatives continue to be implemented that long. However, NFMA directs plans to be revised every 10 to 15 years.

Table 79. Movement toward desired conditions at 15 and 50 years by alternative

PNVT and Percent Departure		Alt. A	Alt. B	Alt. C	Alt. D
Ponderosa Pine Forest	15 year	65	58	52	61
Current Departure = 77	50 year	65	46	48	54
Dry Mixed Conifer Forest	15 year	57	53	49	56
Current Departure = 67	50 year	57	43	44	45
Wet Mixed Conifer Forest	15 year	49	52	56[†]	50
Current Departure = 54	50 year	49	41	59[†]	49
Spruce-Fir Forest	15 year	68[†]	64[†]	63[†]	64[†]
Current Departure = 59	50 year	68[††]	61[††]	60[††]	60[††]

PNVT and Percent Departure		Alt. A	Alt. B	Alt. C	Alt. D
Forested PNVTs	15 year	61	56	52	58
Current Departure = 71	50 year	61	49	50	52
Madrean Pine-Oak Woodland	15 year	59	41	50	28
Current Departure = 61	50 year	59	30	40	19
Woodland PNVTs[a]	15 year	45	33	38	25
Current Departure = 49	50 year	45	25	35	16
Great Basin Grassland	15 year	63	9	63	8
Current Departure = 67	50 year	63	22	68†	16
Semi-Desert Grassland	15 year	89†	66	84†	66
Current Departure = 79	50 year	89††	52	94††	52
Great Basin Grassland and Semi-Desert Grassland[b]	15 year	71†	30	71†	29
Current Departure = 71	50 year	71††	33	78††	29

[a] Includes the piñon-juniper woodland (no species with viability concerns were identified for this PNVT).

[b] Montane/Subalpine Grasslands PNVT was not modeled nor were any of the Riparian PNVTs although three habitat elements came out of the model: snags, coarse woody debris, and acres of large/old trees.

† Indicates where improvement toward desired conditions does not occur from current departure to year 15.

†† Indicates where improvement toward desired conditions does not occur from current to year 50.

All alternatives show an improvement in (reduced departure from) desired conditions at 15 years except in the spruce-fir forest PNVT. At 50 years, trend is static under **alternative A** for all PNVTs while it improves or continues to move toward desired conditions for **all alternatives** in all PNVTs with the exception of those noted by †† above. One reason for this is that **alternatives A and C** treat limited acreage within Great Basin and semi-desert grasslands to restore it to grassland conditions from woody species encroachment. For more explanation, see the "Vegetation Specialist Report" (Forest Service, 2014t) and the "Forest Health Specialist Report" (Forest Service, 2014h).

Habitat Ecological Indicators (EIs)

Aspen and riparian EIs are considered in the viability risk ratings for associated species based on treatment objectives and methods in the forested PNVTs. As such, they contribute to viability and the relative effectiveness of viability among alternatives. For more information on how ecological indicators were developed and evaluated see the Wildlife Specialist Report – Viability (Forest Service, 2014bb).

Aspen EI

Alternatives compared: Direction under the 1987 plan (**alternative A** or the no action alternative) includes clearcutting to convert to aspen from a mixture of aspen with ponderosa pine or mixed conifer, providing big game, nongame, and upland game habitat in aspen, managing livestock to protect aspen regeneration, and retaining an area's visual classification where aspen contribute substantially to visual quality.

The **no action and action alternatives** would have the desired condition to retain aspen on the landscape at the desired (minimum) level of 50,000 acres during the planning period. Aspen would be maintained above that level under **all alternatives** during the 15-year planning period. See appendix G for standards and guidelines related to aspen within the four forested PNVTs.

The amount and condition of aspen would also be affected by actions outside of Forest Service control, presenting additional risk. Two primary examples of aspen loss not related to forest management and activities include wild ungulate browsing of aspen seedlings and saplings and disease (sudden aspen decline or SAD). As an identified plan EI, aspen would be monitored across the forests during the planning period to determine movement toward desired conditions and whether adaptive management is needed. During monitoring, browsing and disease would be recorded as well as impacts from forests management and activities.

Regarding actions outside of the forests' control, **alternative A** would provide the greatest buffer against browsing and disease risks, retaining 71,076 acres of aspen across the forests; while **alternatives B, C, and D** would have similar buffer levels (68,204 acres, 65,796 acres, 65,517 acres, respectively). Hence, this ecological indicator would be maintained on the landscape for **all alternatives**, providing habitat and viability effectiveness for species such as those needing dense canopies or down woody debris (e.g., red-faced warbler, MacGillivray's warbler).

Riparian EI

Alternatives compared: Riparian areas constitute management area 3 under the 1987 plan. Direction includes consideration of grazing utilization standard levels to achieve "fisheries and T&E objectives" and to recover both physical and biological systems, identification of recreation carrying capacity, control of wildlife use where affecting riparian condition, and certain levels (minimums of 60 to 80 percent) of natural shade over water, streambank stability, and woody riparian age class distribution.

Because there are no objectives for treatments under **alternative A**, all riparian PNVTs are estimated to move away from desired conditions (see the "Riparian" section). In addition, **alternative A** would not result in substantial improvement in watersheds that are at risk or impaired (see the "Water Resources" section). **Alternatives B, C, and D** would move toward desired conditions based on riparian and road treatment objectives (see table 3), although less so for **alternative C** because there are road only treatments (no riparian restoration treatments).

Alternatives B, C, and D would maintain or restore the riparian forested PNVTs (mixed broadleaf deciduous, cotton-willow, and montane willow riparian forests) toward desired riparian conditions consisting of, on the landscape scale, (1) natural ecological disturbances (e.g., flooding, scouring) that promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all ages and size classes necessary for the recruitment of riparian-dependent species and (2) riparian-wetland conditions that maintain water-related processes (e.g., hydrologic, hydraulic, geomorphic) and that also maintain the physical and biological community characteristics, functions, and processes. See appendix G for standards and guidelines related to riparian areas and riparian forests.

The amount and condition of riparian forests would also be affected by actions outside of Forest Service control, specifically wild ungulate use (primarily elk and, in places, unauthorized livestock (feral horse) use). As an identified plan EI, riparian forests would be monitored during the planning period to determine if this plant community is moving toward desired conditions and whether adaptive management is needed to move toward or maintain desired conditions. During monitoring, use by other species would be recorded as well as impacts from forests management and activities.

Non-fish Species Viability

Species-Habitat Viability Findings (All FPS)

These findings include all non-fish forest planning species or FPS (ESA, sensitive, highly interactive, and other FPS). For more details, see the Wildlife Specialist Report (Forest Service, 2012bb).

The viability risk rating (VRR) outcomes for each species based on combining the species F ranking and their associated habitat(s)' likelihood of limitation are shown in table 80. In a few instances, the viability risk rating is adjusted as noted in the table. Risk ratings of low and moderate are assumed to pose little risk to viability so are not considered (see assumptions). Hence, only moderately high, high, and very high viability risk ratings are those given additional consideration.

Table 80. Expected viability risk rating[a] (VRR) outcomes for each species-habitat relationship by alternative at 15 years

FPS (forest planning species)	PNVT and/or habitat element	VRR Alt. A	VRR Alt. B	VRR Alt. C	VRR Alt. D
Mammals					
pronghorn antelope	GBG MSG	M M	L L	M L	L L
Mexican wolf	habitat connectivity	MH	M	MH	L
beaver	large trees (riparian forested PNVTs)	L	L	L	L
southern red-backed vole	ample litter and woody debris (WMCF, SFF)	M	MH	MH	M
Townsend's big-eared bat	caves	L	L	L	M
Gunnison's prairie dog[b]	GBG MSG	H H	M M	H MH	M M
spotted bat	cliffs	L	L	L	M
greater western mastiff bat	large trees (MBDRF) cliffs	M L	M L	M L	M M

FPS (forest planning species)	PNVT and/or habitat element	VRR Alt. A	VRR Alt. B	VRR Alt. C	VRR Alt. D
Allen's big-eared bat	large snags (MBDRF) cliffs	M L	MH L	MH L	M M
western red bat	ample debris & litter (MBDRF)	MH	MH	H	MH
ocelot[b]	dense, low vegetation & cover (MBDRF)	MH	M	M	L
lesser long-nosed bat[b]	SDG	L	L	M	MH
long-tailed vole	mosaic of conditions (MSG)	MH	M	M	M
Arizona montane vole	healthy riparian conditions (CWRF, MWRF)	M	L	M	L
Mogollon vole	wet meadow (PPF)	M	M	MH	M
Arizona myotis bat	PPF DMCF	M M	L L	M M	L L
mule deer	MPOW (winter habitat)	M	L	L	L
jaguar[b]	habitat connectivity	M	L	M	L
Springerville pocket mouse	mosaic of conditions (GBG)	MH	L	MH	L
mountain lion	habitat connectivity	M	L	M	L
Abert's squirrel	PPF	L	L	L	L
Arizona gray squirrel	large trees (MBDRF)	M	M	M	M
Merriam's shrew	wet meadow (PPF, DMCF)	MH	M	M	M
dwarf shrew	mosaic of conditions (MSG)	MH	L	M	L
water shrew	water quality (CWRF, MWRF) healthy riparian conditions (CWRF, MWRF)	L MH	L M	L MH	M M
White Mountains ground squirrel	mosaic of conditions (MSG) mosaic of conditions (GBG)	MH MH	L L	M MH	L L
White Mountains chipmunk	ample ground veg, litter (WMCF, SFF)	MH	M	M	L
red squirrel	DMCF WMCF SFF	M M M	L L L	L L L	L L L
black bear	dense low-mid canopy, woody debris (DMCF) WMCF SFF habitat connectivity	M MH MH MH	M L L MH	MH M M L	M L L L

FPS (forest planning species)	PNVT and/or habitat element	VRR Alt. A	VRR Alt. B	VRR Alt. C	VRR Alt. D
New Mexico meadow jumping mouse	H riparian conditions (riparian forested PNVTs)	MH	M	MH	M
Birds					
northern goshawk	PPF DMCF WMCF	L M L	L L L	L L L	L L L
western burrowing owl	mosaic of conditions (GBG)	H	M	MH	M
juniper titmouse	MPOW	M	L	L	L
zone-tailed hawk	PPF	M	L	L	L
common black-hawk	large trees (MBDRF)	L	L	M	L
red-faced warbler	dense, low vegetation & litter (DMCF) WMCF	MH L	L L	M M	L L
Swainson's thrush	ample litter and woody debris (WMCF, SFF)	M	MH	MH	M
evening grosbeak	dense canopies (riparian forested PNVTs)	M	L	M	L
yellow-billed cuckoo	large trees, dense canopies (riparian forested PNVTs)	M	M	M	L
Montezuma quail	mosaic of conditions (GBG) mosaic of conditions (SDG)	MH MH	L M	MH MH	L L
dusky blue grouse	large down woody (WMCF, SFF)	M	MH	MH	M
Grace's warbler	PPF	L	L	L	L
gray catbird	dense low-mid canopy (riparian forested PNVTs)	M	L	M	L
southwestern willow flycatcher	dense low-mid canopy (MWRF) healthy riparian conditions (MWRF)	MH MH	M M	M MH	L M
peregrine falcon	cliffs healthy riparian conditions (riparian forested PNVTs)	L M	L L	L M	M L
bald eagle	water quality (CWRF, MBDRF) large trees (all forests)	L M	L M	L MH	M M
Lincoln's sparrow	healthy riparian conditions (MWRF)	MH	M	MH	M
MacGillivray's warbler	dense low-mid canopy (riparian forested PNVTs)	MH	M	M	L

FPS (forest planning species)	PNVT and/or habitat element	VRR Alt. A	VRR Alt. B	VRR Alt. C	VRR Alt. D
flammulated owl	PPF DMCF	M M	L L	L M	L L
savannah sparrow	MSG	M	L	M	L
Mexican spotted owl	DMCF WMCF MPOW PPF where Gambel oak present	H H MH MH	M M M M	MH MH M M	M M M L
gray vireo	MPOW	M	M	M	M
Reptiles/Amphibians					
Arizona toad	water quality (MBDRF)	L	L	L	M
Chiricahua leopard frog	water quality	M	M	M	MH
northern leopard frog	water quality	M	M	M	MH
lowland leopard frog	water quality	L	L	L	M
northern Mexican gartersnake	water quality healthy riparian conditions	L MH	L M	L MH	M M
narrow-headed gartersnake	water quality healthy riparian conditions	L MH	L M	L MH	M M
Invertebrates					
plateau giant tiger beetle	SDG	H	MH	H	M
false ameletus mayfly	water quality	L	L	L	M
California floater	water quality	M	M	M	MH
Mosely caddisfly	water quality	M	M	M	MH
Ferris' copper butterfly	wet swale (MSG) WCRA	MH MH	M M	M M	M M
Alberta arctic butterfly	MSG	MH	L	M	L
Arizona snaketail dragonfly	water quality	L	L	M	M
four-spotted skipperling butterfly	wet meadow or shaded opening (PPF)	M	M	MH	M
White Mountains water penny beetle	water quality	L	L	M	M
Three Forks springsnail	water quality	MH	MH	MH	MH
nitocris fritillary butterfly	wet swales (MSG) WCRA	MH MH	M L	M M	M L

FPS (forest planning species)	PNVT and/or habitat element	VRR Alt. A	VRR Alt. B	VRR Alt. C	VRR Alt. D
nokomis fritillary butterfly	wet swales (MSG) WCRA	MH MH	M L	M M	M L
Plants					
Bigelow’s onion	MPOW SDG	M M	L M	M M	L L
Goodding’s onion	cool microclimate (DMCF)	L	M	MH	M
Greene milkweed	mosaic of conditions (MPOW) mosaic of conditions (GBG)	H H	M M	MH H	M M
crenulate moonwort	SFF	M	M	M	M
White Mountains paintbrush	WMCF (meadows) SFF (meadows)	L L	L L	L L	M M
Mexican hemlock parsley	cool microclimate (MPOW)	L	M	MH	M
yellow lady’s slipper[c]	(WMCF, SFF-collection)	—	—	—	—
Arizona sneezeweed	wet meadow (PPF)	H	MH	MH	MH
Arizona sunflower	mosaic of conditions (GBG) mosiac of treatment (SDG)	M M	L L	M M	L L
Eastwood alumroot	canyon slopes	L	L	L	M
Arizona alumroot	canyon slopes	L	L	L	M
wood nymph	WMCF SFF	L L	L L	M M	L L
heathleaf (bittercress) ragwort	shaded forest opening (WMCF, SFF)	L	L	M	L
superb penstemon	mosaic of conditions (SDG)	L	L	L	M
yellow Jacob’s-ladder[c]	(WMCF, SFF-collection)[c]	—	—	—	—
Davidson’s cliff carrot	cliffs, canyon slopes	L	L	L	M
Parish alkali grass	wet alkali swales (GBG)	MH	M	M	M
Blumer’s dock	water quality healthy riparian conditions (MWRF)	L M	L L	L M	M L
Arizona willow	healthy riparian conditions (MWRF)	MH	M	M	M
Bebb willow	healthy riparian conditions (MWRF)	MH	L	M	L
hooded lady’s tresses[c]	(WMCF, SFF-collection)	—	—	—	—
splachnoid dung moss	MSG	L	L	L	M

FPS (forest planning species)	PNVT and/or habitat element	VRR Alt. A	VRR Alt. B	VRR Alt. C	VRR Alt. D
Mogollon clover	wet meadow, shaded forest opening (PPF)	M	M	MH	M
Oak Creek triteleia	shaded forest opening (PPF)	M	M	MH	M
carnivorous bladderwort	water quality	L	L	M	M

Table rating descriptions or other information:

[a] Viability risk ratings are VH = very high; H = high; and MH = moderately high. Ratings of moderate (M) to low (L) are not considered to be of consequence for species viability (see the assumptions).

[b] Although not known on the planning unit, the viability risk rating is determined as if present to avoid overestimating their F? ranking.

[c] Plant collection, not the PNVT or habitat element, is the risk for these species.

Table 81 lists the species where viability risk ratings are L or M across **all alternatives** within all their habitat components. These species include most, but not all, of the coarse filter species (see table 66). These ratings indicate that forest management and activities are expected to result in effects no more substantial than normal ecosystem fluctuations, thus posing no risk to viability; therefore, viability is assured for the following species. These 36 species are not further analyzed except more information is provided in following sections for those that are ESA or sensitive species.

Table 81. Species for which habitat (PNVT) alone is sufficient to provide viability

PNVT - coarse filter	FPS (forest planning species)
Ponderosa Pine Forest (PPF)	Abert’s squirrel, Arizona myotis bat, northern goshawk, zone-tailed hawk, Grace’s warbler, flammulated owl, four-spotted skipperling butterfly
Dry Mixed Conifer Forest (DMCF)	Arizona myotis bat, red squirrel, northern goshawk, flammulated owl
Wet Mixed Conifer Forest (WMCF)	red squirrel, northern goshawk, White Mountains paintbrush, heathleaf ragwort
Madrean Pine-Oak Woodland (MPOW)	mule deer, juniper titmouse
Montane/Subalpine Grasslands (MSG)	pronghorn antelope, savannah sparrow, splachnoid dung moss
Great Basin Grassland (GBG)	pronghorn antelope
Semi-Desert Grassland (SDG)	superb penstemon, Arizona sunflower
All PNVTs	Townsend’s big-eared bat, spotted bat, Arizona montane vole, Eastwood alumroot, Arizona alumroot, Davidson’s cliff carrot
All Riparian PNVTs	Greater western mastiff bat, Arizona gray squirrel, common black-hawk, evening grosbeak, yellow-billed cuckoo, gray catbird, peregrine falcon, Arizona toad, lowland leopard frog, false ameletus mayfly, Arizona snaketail dragonfly, Blumer’s dock, carnivorous bladderwort

Species-Habitat Relationships Across Habitats

While **all alternatives** provide for the needs of species, they do so at different levels of viability effectiveness. In order to compare how effectively each alternative addresses species needs, table 82 sums the viability risk ratings from table 80 by PNVTs for each alternative. Within each habitat element, the alternative with the least viability effectiveness is noted by dashes (- -). The lower the number of viability risk ratings, the more effective the alternative is in providing for viability. As previously noted, fine filter standards and guidelines are developed to help address viability effectiveness beyond PNVTs as needed.

Table 82. Number of species-habitat relationships as an indicator of viability effectiveness by habitat element(s) for each alternative (subtotals and totals)

Habitat Elements	Alt. A	Alt. B	Alt. C	Alt. D
Ponderosa Pine Forest	3	0	-5-	0
Dry Mixed Conifer Forest	-4-	0	2	0
Wet Mixed Conifer Forest	3	3	-4-	0
Spruce-Fir Forest	2	2	2	2
Subtotal number of viability risk ratings across Forested PNVTs	**12**	**5**	**13**	**2**
Madrean Pine-Oak Woodland	-3-	1	-3-	2
Subtotal number of viability risk ratings across Forested and Woodland PNVTs	**15**	**6**	**16**	**4**
Montane/Subalpine Grassland	-8-	0	1	0
Great Basin Grassland	-7-	0	6	0
Semi-desert Grassland	-2-	1	1	1
Subtotal number of viability risk ratings across Grassland PNVTs	**17**	**1**	**8**	**1**
All Riparian PNVTs	-14-	2	8	1
Total number of viability risk ratings across all PNVTs	**46**	**9**	**32**	**6**

Of the seven individual PNVTs and the grouped riparian PNVTs above, **alternative A** has the least overall viability effectiveness among these PNVTs, followed by **alternative C**. **Alternative D**, followed by **alternative B**, has the greatest viability effectiveness among these PNVTS. However, few species occur across all PNVTs so comparison of ratings is most relevant by PNVT.

Species-Habitat Relationships by Species Groups

While all alternatives provide species viability, they do so at different levels of effectiveness. In order to compare how effectively each alternative addresses species needs, table 82 sums the viability risk ratings from table 80 by species groups for each alternative. The lower the number of viability risk ratings, the more effective the alternative is in providing for viability. As noted above, fine filter standards and guidelines are developed to help address viability effectiveness as well.

Table 83. Number of species-habitat relationships as an indicator of viability effectiveness by FPS group for each alternative

Viability Risk Ratings Comparing Alternative Viability Effectiveness	Alt. A	Alt. B	Alt. C	Alt. D
ESA species	9	1	5	3
Sensitive species[a]	27	4	21	4
Remaining FPS[b]	10	3	9	1
Total	46	7	35	7

[a] Includes ESA candidate species.

[b] Includes highly interactive species not in another category but does not include MIS.

Overall, **alternatives B and D** provide the greatest viability effectiveness as compared to **alternative C**, followed by **alternative A**. This relationship holds for ESA and sensitive FPS as a group and for the remaining FPS. However, as previously noted, few species occur across all PNVTs so comparison of ratings is most relevant by PNVT.

Endangered Species Act Species and Critical Habitat

Overall Consequences to All ESA Species

All ESA species are forest planning species (FPS). Viability risk ratings for ESA species as FPS are previously included in table 80. The management effect, as a reflection of plan objectives for each alternative, is previously shown in table 78 which includes those habitats needed by ESA species.

Sections of the plan that contain plan decisions (components) relative to ESA species at the coarse and fine filter levels are indicated in table 84. These are followed by a comparison of the relative overall viability effectiveness of the alternatives for ESA species. Some key plan components that help meet the needs of ESA species are discussed in more detail in the following individual species discussions.

Table 84. Sections of the plan containing plan decisions that address ESA species at the coarse and fine filter levels

Plan Decisions	Desired Conditions	Objectives	Standards	Guidelines
Coarse filter plan decisions that provide viability for: All ESA Species	Overall Ecosystem Health Water Resources Aquatic Habitat and Species All PNVTs Riparian Areas All Forested PNVTs Ponderosa Pine Dry Mixed Conifer Wet Mixed Conifer Spruce-Fir Madrean Pine-Oak Wildlife and Rare Plants Overall Recreation Opportunities Dispersed Recreation Developed Recreation Livestock Grazing Heber Wild Horse Territory Management Area Wildlife Quiet Area Management Area Natural Landscape Management Area Recommended Research Natural Area Management Area	Ecosystem Health Water Resources Soil Aquatic Habitat and Species Riparian Areas All Forested PNVTs All Woodland PNVTs Grasslands Wildlife and Rare Plants Invasive Species Dispersed Recreation Lands Water Uses		

Plan Decisions	Desired Conditions	Objectives	Standards	Guidelines
Fine filter plan decisions in addition to the coarse filter plan decisions above that provide viability for: All ESA Species			Aquatic Habitat and Species Invasive Species Forest Products Livestock Grazing Special Uses Water Uses	Water Resources Aquatic Habitat and Species All PNVTs Riparian Areas All Forested PNVTs Ponderosa Pine Forests Dry Mixed Conifer Forests Madrean Pine-Oak Woodland Wildlife and Rare Plants Invasive Species Overall Recreation Opportunities Dispersed Recreation Motorized Opportunities Nonmotorized Opportunities Special Uses, Energy Corridor Management Area

Overall Alternative Comparisons for ESA species

A**ll alternatives**, to varying degrees, help reduce risks to species and their habitat thereby improving viability for ESA species as well. Plan implementation under **alternatives B, C, and D** (less so for **alternative A**) would move habitat toward desired conditions over the long term and plan components would help to minimize potential short-term plan implementation impacts from to ESA species and their critical habitat. Overall, based on tables 78 and 80, **alternatives B and D** have the greatest viability effectiveness for ESA species and their habitat, as compared to **alternative C**, followed by **alternative A** (also see table 83). For more information, see the individual species sections below.

ESA Determinations for All Alternatives

Two biological assessments (BAs) address effects of forest plans to ESA species in accordance with Section 7(a)(1) of the Endangered Species Act. Determination of effects for the continued implementation of the 1987 Apache-Sitgreaves NFs land and resource management plan are found in the April 6, 2011 BA (Forest Service, 2011a). These findings are shown in table 85 (non-fish ESA species) and represent the determination of effects to 2011 species and critical habitat should alternative A, the 1987 forest plan, continue to be implemented. Findings for ESA fish species are found in table 18.

Note that since the 2011 BA and since the publication of the DEIS for forest plan revision, there have been changes in some non-fish species' listing status under the ESA and some new species and critical habitat have been added or proposed. These changes are addressed in the May 29, 2014, biological assessment (Forest Service, 2014cc) that analyzes implementation of alternative B for plan revision. The determination of effects for species and critical habitat listed in 2014 and BA findings are also shown in table 85. This BA was submitted to the U.S. Fish and Wildlife Service for formal consultation on May 29, 2014.

Note that it is assumed that implementation of alternatives C and D would result in similar determinations as alternative B, although the level of effects to ESA species would likely be different. However, alternatives C and D are not analyzed in a biological assessment.

Table 85. Determination of effects (findings) for ESA species for alternatives A and B

Species	Status 2011 (species followed by critical habitat)	2011 BA findings (alternative A)[a]	Status 2014 (species followed by critical habitat)	2014 BA Finding (alternative B)
Mexican wolf	Experimental, nonessential (ENE) --	Not likely to jeopardize --	Experimental, nonessential (ENE) --	Not likely to jeopardize --
Mexican spotted owl	Threatened Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect	Threatened Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect
Southwestern willow flycatcher	Threatened Critical habitat[b]	May affect, likely to adversely affect May affect, likely to adversely affect	Threatened Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect
Chiricahua leopard frog	Threatened Proposed critical habitat[c]	May affect, likely to adversely affect May affect, likely to adversely affect, when listed	Threatened Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect
Three Forks springsnail	Candidate[d] --	Not likely to jeopardize (may affect, likely to adversely affect, if listed) --	Endangered Critical habitat	May affect, likely to adversely affect May affect, likely to adversely affect
Narrow-headed gartersnake	Not listed --	-- --	Threatened Proposed critical habitat	May affect, likely to adversely affect Not likely to adversely modify (may affect, likely to adversely affect, if listed)

Species	Status 2011 (species followed by critical habitat)	2011 BA findings (alternative A)[a]	Status 2014 (species followed by critical habitat)	2014 BA Finding (alternative B)
Northern Mexican gartersnake	Not listed ---	--- ---	Threatened Proposed critical habitat	May affect, likely to adversely affect Not likely to adversely modify (may affect, likely to adversely affect, if listed)
Western yellow-billed cuckoo	Not listed ---	--- ---	Proposed threatened Proposed critical habitat	Not likely to jeopardize (may affect, likely to adversely affect, if listed) Not likely to adversely modify (may affect, likely to adversely affect, if listed)
New Mexican meadow jumping mouse	Not listed ---	--- ---	Endangered Proposed critical habitat	May affect, likely to adversely affect Not likely to adversely modify (may affect, likely to adversely affect, if listed)
Lesser long-nosed bat	Endangered ---	No effect ---	Endangered[e] ---	No effect ---

[a] Determinations based on 2011 status unless otherwise noted.

[b] Critical habitat for the southwestern willow flycatcher was designated Jan. 3, 2013.

[c] Critical habitat for the Chiricahua leopard frog was designated Mar. 20, 2012.

[d] Three Forks springsnail was listed Endangered and critical habitat was designated Apr. 17, 2012.

[e] The 2011 BA and 2012 BO did not address the lesser long-nosed bat for the Apache-Sitgreaves NFs; however, for forest plan revision, this species is included as a FPS, see below.

Alternative Consequences by Individual ESA Species

ESA determinations of effects as well as comparison of alternatives for individual ESA species follow. Where applicable, determination of effects to their proposed or designated critical habitat is included. Alternatives B, C, and D are considered the action alternatives. For more details about alternative A and associated ESA species and critical habitat, see the April 6, 2011 BA (Forest Service, 2011a) and the biological and conference opinion (BO/CO) for the continued implementation of the Apache-Sitgreaves NFs land and resource management plan (USFWS, 2012a).

Mexican Spotted Owl: Threatened with Critical Habitat

Alternative A: See table 85 and the 2011 BA (Forest Service, 2011a) and the 2012 BO/CO (USFWS, 2012a), as noted above.

Alternatives B, C, and D: The action alternatives provide objectives, desired conditions, standards, and guidelines favorable for the Mexican spotted owl and its critical habitat. Some examples of key plan components that address the needs of this species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Uncharacteristic fire behavior is minimal or absent on the landscape.
- Desired Condition: Old or large trees, multistoried canopies, large coarse woody debris, and snags provide the structure, function, and associated vegetation composition as appropriate for each forested and woodland PNVT.
- Desired Condition: Herbaceous vegetation amount and structure (e.g., plant density, height, litter, seed heads) provides habitat to support wildlife and prey species.
- Desired Condition: Some isolated infestations of mistletoe provide for a diversity of habitat components (e.g., food, nesting, cover) for a variety of species such as owls, squirrels, and some birds and insects.
- Desired Condition: Some large patches in the Madrean pine-oak woodland are closed canopy, have multiple age classes, large trees, and old growth-like characteristics (e.g., numerous snags, large coarse woody debris) in order to provide for wildlife such as Mexican spotted owl and black bear that need denser habitat.
- Desired Condition: Where it naturally occurs, Gambel oak is present with all age classes represented. It is reproducing to maintain or expand its presence on capable sites across the landscape. Large Gambel oak snags are typically 10 inches or larger in diameter and are well distributed.
- Desired Condition: Snags and coarse woody debris are well distributed throughout the landscape. Snags are typically 18 inches in diameter or greater and average 3 per acre.
- Standard: Permits which authorize the collection of forest products shall include permit provisions to ensure the needs of wildlife, which depend upon those forest products, will continue to be met (e.g., cone and mushroom collection and the overwinter forage needs of squirrels).
- Standard: Motorized vehicle travel shall be managed to occur only on the designated system of NFS roads and motorized trails and designated motorized areas.
- Guideline: Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- Guideline: Where Mexican spotted owls are found nesting in canyons or on north slopes within Madrean pine-oak woodland, adjacent treatments should be modified to meet the needs of foraging owls.
- Guideline: Trees, snags, and logs immediately adjacent to active red squirrel cone caches, Abert's squirrel nests, and raptor nests should be retained to maintain needed habitat components and provide tree groupings.

- Guideline: Where current forests are lacking proportional representation of late seral states and species composition on a landscape scale, old growth characteristics should be retained or encouraged to the greatest extent possible within the scope of meeting other desired conditions (e.g., reduce impacts from insects and disease, reduce the threat of uncharacteristic wildfire). (Note that this guideline applies to *alternatives A, B,* and *D,* but not to *alternative C.*)
- Guideline: Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions.
- Guideline: Activities occurring within federally listed species habitat should apply habitat management direction and species protection measures from recovery plans.

In addition to the alternative C exception noted above, differences among alternatives relate primarily to differences in treatment objectives and overall management effect. All of the alternatives have forested PNVT restoration objectives (table 3) that would help improve habitat for Mexican spotted owl. All alternatives use both thinning and wildland fire treatments and all have an emphasis for treatment in the dry mixed conifer and ponderosa pine forested PNVTs which would include some restoration treatments in owl ponderosa pine-oak habitats. Table 86 shows treatment acres that were modeled by alternative.

Table 86. Modeled acres treated per year in MSO PNVTs (high treatment level)

PNVT	Alt. A	Alt. B	Alt. C	Alt. D
Ponderosa Pine	10,721	23,249	35,842	31,901
Dry Mixed Conifer	601	7,150	11,150	9,501
Wet Mixed Conifer	542	6,132	9,432	7,066
Spruce-Fir[a]	16	750	1,111	1,000
Total annual modeled acreage treated	**11,880**	**37,281**	**57,535**	**49,468**

[a] Note that the spruce-fir PNVT on the Apache-Sitgreaves NFs meets the definition of “mixed conifer” in the 2012 MSO Recovery Plan.

Besides the overall alternative comparisons of above, comparisons of individual forested PNVTs providing habitat are included for the Mexican spotted owl. For the ponderosa pine forest PNVT, movement toward desired conditions is greatest under **alternative C**, followed by **alternatives D, then B, and A**. For the dry mixed conifer forest PNVT, the order is the same for alternatives C and A, but alternatives D and B are reversed. For the wet mixed conifer forested PNVT, movement toward desired conditions is greatest under **alternative A,** followed by **alternatives D, then B and C.** Under **all alternatives**, the spruce-fir forest PNVT initially moves further away from desired conditions over the 15-year planning period; however, less than 3 percent of owl protected habitat within PACs is composed of this PNVT and trend changes toward desired conditions by year 50).

Desired conditions and objectives included for alternative B would help improve owl habitat by promoting the restoration of PNVTs, natural fire regimes, and riparian restricted habitat, and by incorporating recovery actions and strategies for federally listed species. While standards and guidelines help reduce short-term plan implementation impacts, not all potential negative effects (e.g., disturbance) from plan implementation would be precluded. As such, the biological assessment (Forest Service, 2014cc) determined that **alternative B may affect and is likely to adversely affect** the Mexican spotted owl.

Plan components help provide for primary constituent elements of critical habitat such as large trees and snags, large woody debris, and herbaceous plant cover and seeds for prey. However, the extent to which standards and guidelines reduce or eliminate impacts cannot be considered insignificant or discountable. As such, the biological assessment determined that **alternative B may affect and is likely adversely affect** Mexican spotted owl critical habitat.

Climate and cumulative effects: Research predicts that as climate changes, water inputs are expected to decline due to reduced overall precipitation (Forest Service, 2010b). This has the potential to move the lower elevational limits of dry mixed conifer, wet mixed conifer, and spruce-fir forests upward, thereby reducing suitable Mexican spotted owl habitat across the forests. The White Mountain Apache Reservation and the San Carlos Indian Reservation have timber programs that could cumulatively affect the owl and its critical habitat, although details of those programs are unknown.

Southwestern Willow Flycatcher: Endangered with Critical Habitat

Alternative A: See above.

Alternatives B, C, and D: The **action alternatives** provide objectives, desired conditions, standards, and guidelines favorable for the southwestern willow flycatcher and its critical habitat. Some examples of key plan components that address the needs of this species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Habitat and ecological conditions are capable of providing for self-sustaining populations of native, riparian dependent plant and animal species.
- Desired Condition: Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.
- Desired Condition: Vegetation and soil conditions above the floodplain protect downstream water quality, quantity, and aquatic habitat.
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Standard: Aerial retardant drops should avoid threatened, endangered, proposed, or candidate, or identified sensitive species and waterways.
- Standard: Streams on NFS lands with high aquatic values and at risk from new water diversions shall be preserved and protected with instream flow water rights.
- Guideline: Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.
- Guideline: Critical areas [e.g., riparian areas] should be managed to address the inherent or unique site factors, condition, values, or potential conflicts.
- Guideline: Constraints (e.g., maximum limit to which water level can be drawn down or minimum distance from a connected river, stream, wetland, or groundwater-dependent

ecosystem) should be established for new groundwater pumping sites permitted on NFS lands in order to protect the character and function of water resources.

- Guideline: Dispersed campsites should not be located on or adjacent to archaeological sites or sensitive wildlife areas.
- Guideline: Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions.
- Guideline: Activities occurring within federally listed species habitat should apply habitat management direction and species protection measures from recovery plans.

Besides the overall alternative comparisons above, comparison of PNVTs providing habitat are included for the Southwestern willow flycatcher. For both the montane willow and mixed broadleaf deciduous riparian forest PNVTs, movement toward desired conditions is greatest under **alternatives B and D**, and least under **alternatives A and C**.

Desired conditions and objectives included for alternative B would help improve flycatcher habitat by promoting restoration of upland PNVTs, watersheds, and riparian vegetation, and by incorporating recovery actions and strategies for federally listed species. While standards and guidelines help reduce short-term plan implementation impacts, not all potential negative effects (e.g., disturbance, reduced flows) would be precluded. As such, the biological assessment determined that **alternative B may affect and is likely to adversely affect** the Southwestern willow flycatcher.

Plan components help provide for primary constituent elements of critical habitat such as dense riparian thickets and associated watered floodplains for insect prey. However, the extent to which standards and guidelines reduce or eliminate plan implementation impacts cannot be considered insignificant or discountable. As such, the biological assessment determined that **alternative B may affect and is likely to adversely affect** Southwestern willow flycatcher critical habitat.
Climate and cumulative effects: Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation, with the potential to reduce water in riparian zones (Forest Service, 2010b) and, thereby, possibly reducing riparian nesting habitat for the southwestern willow flycatcher. All three nesting sites and much of the critical habitat for this species are adjacent to or surrounded by private land. Increased housing and other development with associated wells could reduce the groundwater table in the Greer and Alpine areas which could lower streamflows and reduce the wetted portion of the floodplain that supports the extensive willow stands and insect prey used by nesting flycatchers. In addition, elk management and numbers which have and can impact the development of tall, extensive willow.

Western Yellow-billed Cuckoo: Proposed Threatened Habitat

Alternative A: See above.

Alternatives B, C, and D: The action alternatives provide objectives, desired conditions, standards, and guidelines favorable for the western yellow-billed cuckoo. Some key examples of plan components that address the needs of this species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species. Desired Condition: Habitat and ecological conditions are capable of providing for self-sustaining populations of native, riparian dependent plant and animal species.
- Desired Condition: Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.

- Desired Condition: Vegetation and soil conditions above the floodplain protect downstream water quality, quantity, and aquatic habitat.
- Desired Conditions: Livestock grazing is in balance with available forage (i.e., grazing and browsing by authorized livestock, wild horses, and wildlife do not exceed available forage production within established use levels).
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Standard: Streams on NFS lands with high aquatic values and at risk from new water diversions shall be preserved and protected with instream flow water rights.
- Guideline: Aerial retardant drops should avoid threatened, endangered, proposed, or candidate, or identified sensitive species and waterways.
- Guideline: Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.
- Guideline: Critical areas [e.g., riparian areas] should be managed to address the inherent or unique site factors, conditions, values, or potential conflicts associated with them.
- Guideline: To prevent resource damage (e.g., stream banks) and disturbance to federally listed and sensitive wildlife species, trailing of livestock should not occur along riparian areas. Where no alternative route is available, approval may be granted where effective mitigation measures are implemented (e.g., timing of trailing, number of livestock trailed at one time).
- Guideline: Streambed and floodplain alteration or removal of material should not occur if it prevents attainment of riparian, channel morphology, or streambank desired conditions.
- Guideline: Cool and/or dense vegetation cover should be provided for species needing these habitat components (e.g., Goodding’s onion, black bear, White Mountains chipmunk, western yellow-billed cuckoo).
- Guideline: Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions.

Besides the overall alternative comparisons above, comparison of PNVTs providing habitat are included for the western yellow-billed cuckoo. For both the mixed broadleaf deciduous and cottonwood-willow forested riparian PNVTs, movement toward desired conditions is greatest under **alternatives B and D**, and least under **alternatives A and C**.

Desired conditions and objectives included for **alternative B** would help improve habitat for the cuckoo by promoting restoration of upland PNVTs, natural fire regimes, and watersheds that influence the health of riparian areas, and direct restoration within riparian areas. The biological assessment determined that **alternative B would not likely jeopardize** the continued existence of the western yellow-billed cuckoo in its current proposed status. However, standards and guidelines would not preclude all short-term plan implementation impacts (e.g., road maintenance, livestock grazing). As such, the biological assessment also determined that plan implementation under **alternative B may affect and is likely to adversely affect** the western yellow-billed cuckoo, if listed.

Plan components help provide for primary constituent elements of proposed critical habitat in riparian and floodplain areas such as dynamic river flow conditions that support well developed riparian woody species with dense canopies with an adequate prey base in large (200 acre) and wide (325 feet) patches. The biological assessment determined that **alternative B would not likely result in adverse modification** of proposed critical habitat for the cuckoo. However, standards and guidelines would not preclude all short-term plan implementation impacts. As such, the biological assessment also determined that plan implementation under **alternative B may affect and is likely to adversely affect** critical habitat, if listed, for the western yellow-billed cuckoo.

Climate and cumulative effects: Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation, consequently reducing water and the riparian vegetation that needed by the western yellow-billed cuckoo (Forest Service, 2010b). There is one large parcel of private land along the San Francisco River and many private land parcels along Eagle Creek. Activities on these private lands include water impoundment, diversion, livestock grazing, roads, home sites, and livestock handling facilities.

Chiricahua Leopard Frog: Threatened with Critical Habitat

Alternative A: See above.

Alternatives B, C, and D:

The action alternatives provide objectives, desired conditions, standards, and guidelines favorable for the Chiricahua leopard frog and its critical habitat. Some key examples of key plan components that address the needs of this species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Water quality meets the needs of desirable aquatic species such as the California floater, northern and Chiricahua leopard frog, and invertebrates that support fish populations.
- Desired Condition: Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of native and desirable nonnative plants and animals that are healthy, well distributed, connected, and genetically diverse. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the landscape.
- Desired Condition: Riparian obligate species within wet meadows, along stream banks, and active floodplains provide sufficient vegetative ground cover (herbaceous vegetation and litter cover) to protect and enrich soils, trap sediment, mitigate flood energy, stabilize stream banks, and provide for wildlife and plant needs.
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Standard: Projects and authorized activities shall be designed to reduce the potential for the introduction of new species or spread of existing invasive or undesirable aquatic or terrestrial nonnative populations.

- Standard: Streamside management zones should be in place between streams and disturbed areas and/or road locations to maintain water quality and suitable stream temperatures for aquatic species.
- Guideline: Aerial retardant drops should avoid threatened, endangered, proposed, or candidate, or identified sensitive species and waterways.
- Guideline: Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.
- Guideline: To minimize potential resource impacts from livestock, salt or nutritional supplements should not be placed within a quarter of a mile of any riparian area or water source. Salt or nutritional supplements should also be located to minimize herbivory impacts to aspen clones.
- Guideline: Wet meadows and cienegas should not be used for concentrated activities (e.g., equipment storage, forest product or mineral stockpiling, livestock handling facilities, special uses) that cause damage to soil and vegetation.
- Guideline: Dispersed campsites should not be located on or adjacent to archaeological sites or sensitive wildlife areas.
- Guideline: Activities occurring within federally listed species habitat should apply habitat management direction and species protection measures from recovery plans.

Other plan decisions would also help provide for the needs of the Chiricahua leopard frog. The recommended Three Forks Research Natural Area would afford additional protection by precluding the impacts from livestock grazing, timber production, new motorized roads, trails, and temporary roads in the Three Forks area where the species has occurred. The recommended Lower Campbell Blue research natural area would also afford the same protection to locations of the frog in Campbell Blue and Coleman Creeks.

Besides the overall alternative comparisons above, comparison of PNVTs providing habitat are included for the Chiricahua leopard frog. For both the wetland/cienega riparian PNVT and the montane willow riparian forest PNVT, movement toward desired conditions is greatest under **alternatives B and D**, and least under **alternatives A and C**.

Desired conditions and objectives included for alternative B would help improve habitat for the frog by promoting restoration of upland PNVTs, watershed and riparian areas, and by incorporating recovery actions and strategies for federally listed species. While standards and guidelines would help reduce short-term plan implementation impacts, not all potential negative effects (e.g., water quality, loud noises during breeding) would be precluded. As such, the biological assessment determined that **alternative B may affect and is likely to adversely affect** the Chiricahua leopard frog.

Plan components help provide for primary constituent elements of critical habitat in riparian and adjacent upland areas such as fresh water, emergent/submerged vegetation, root masses, and suitable dispersal corridors. However, the extent to which standards and guidelines reduce or eliminate plan implementation impacts cannot be considered insignificant or discountable. As such, the biological assessment determined that **alternative B may affect and is likely to adversely affect** critical habitat for the Chiricahua leopard frog.

Climate and cumulative effects: Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation, consequently reducing water in riparian zones (Forest Service, 2010b) and potentially reducing the aquatic habitat needed by the Chiricahua leopard frog. There is one 5-acre private land parcel in upper Campbell Blue Creek that has an older house, although the site could be further developed. There is another 86-acre property below occupied and critical habitat on lower Campbell Blue Creek although no activities on or associated with this private land are known to be affecting occupied frog habitat upstream of this private land. Spring and summer elk use impacts riparian conditions in the Three Forks area (wallowing) and two tanks (bank trampling) where the frog has been stocked. In addition, elk and deer utilize Campbell Blue and Coleman Creeks as general movement corridors between spring/summer and fall/winter habitat.

Narrow-headed Gartersnake: Threatened with Proposed Critical Habitat
Northern Mexican Gartersnake: Threatened with Proposed Critical Habitat

Alternative A: See above.

Alternatives B, C, and D: The action alternatives provide objectives, desired conditions, standards, and guidelines favorable for the narrow-headed and northern Mexican gartersnakes and their proposed critical habitat. Some key examples of plan components that address the needs of these species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of native and desirable nonnative plants and animals that are healthy, well distributed, connected, and genetically diverse. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the landscape.
- Desired Condition: Riparian obligate species within wet meadows, along stream banks, and active floodplains provide sufficient vegetative ground cover (herbaceous vegetation and litter cover) to protect and enrich soils, trap sediment, mitigate flood energy, stabilize stream banks, and provide for wildlife and plant needs.
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Standard: Streamside management zones should be in place between streams and disturbed areas and/or road locations to maintain water quality and suitable stream temperatures for aquatic species.
- Guideline: Aerial retardant drops should avoid threatened, endangered, proposed, or candidate, or identified sensitive species and waterways.
- Guideline: Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.
- Guideline: Critical areas [e.g., riparian area] should be managed to address the inherent or unique site factors, condition, values, or potential conflicts.
- Guideline: To prevent resource damage (e.g., stream banks) and disturbance to federally listed and sensitive wildlife species, trailing of livestock should not occur along riparian areas. Where no alternative route is available, approval may be granted where effective mitigation measures are implemented (e.g., timing of trailing, number of livestock trailed at one time).

- Guideline: Streamside management zones should be in place between streams and disturbed areas and/or road locations to maintain water quality and suitable stream temperatures for aquatic species.
- Guideline: Roads and motorized trails should be designed and located so as to not impede terrestrial and aquatic species movement and connectivity.
- Guideline: Streambed and floodplain alteration or removal of material should not occur if it prevents attainment of riparian, channel morphology, or streambank desired conditions.
- Guideline: Wet meadows and cienegas should not be used for concentrated activities (e.g., equipment storage, forest product or mineral stockpiling, livestock handling facilities, special uses) that cause damage to soil and vegetation.
- Guideline: Dispersed campsites should not be located on or adjacent to archaeological sites or sensitive wildlife areas.

Besides the overall alternative comparisons above, comparisons of PNVTs providing habitat are included for the narrow-headed and northern Mexican gartersnake. For the mixed broadleaf deciduous, cottonwood-willow and montane willow riparian forested PNVTs, movement toward desired conditions is greatest under **alternatives B and D**, and least under **alternatives A and C**.

Desired conditions and objectives included for **alternative B** would help improve habitat for these two gartersnakes by promoting restoration of restoration of upland and riparian PNVTs, watersheds, and soils. While standards and guidelines would help reduce short-term plan implementation impacts, not all potential negative effects (e.g., sediment or grazing) would be precluded. As such the biological assessment determined that **alternative B may affect and is likely to adversely affect** the narrow-headed and northern Mexican gartersnakes.

Plan components help provide for primary constituent elements of proposed critical habitat in riparian and floodplain areas such as unregulated water flows, complexity (rocks, logs, debris) within adequate terrestrial space extending to 600 feet (182.9 meters) to either side of bankfull stage), and an amphibian and native, non-spiny fish prey base. The biological assessment determined that **alternative B would not likely result in adverse modification** of proposed critical habitat for these two gartersnakes. However, standards and guidelines would not preclude all short-term plan implementation impacts. As such, the biological assessment also determined that plan implementation under **alternative B may affect and is likely to adversely affect** critical habitat, if listed, for the narrow-headed and northern Mexican gartersnake.

Three Forks Springsnail: Endangered with Critical Habitat

Alternative A: See above.

Alternatives B, C, and D: The action alternatives provide objectives, desired conditions, standards, or guidelines favorable for the Three Forks springsnail and its critical habitat. Some examples of key plan components that address the needs of this species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Vegetation and soil condition above the floodplain contribute to downstream water quality, quantity, and aquatic habitat.
- Desired Condition: Habitat and ecological conditions are capable of providing for self-sustaining populations of native, riparian dependent plant and animal species.

- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Standard: Projects and authorized activities shall be designed to reduce the potential for introduction of new species or spread of existing invasive or undesirable aquatic or terrestrial nonnative populations.
- Standard: Streamside management zones should be in place between streams and disturbed areas and/or road locations to maintain water quality and suitable stream temperatures for aquatic species.
- Guideline: Aerial retardant drops should avoid threatened, endangered, proposed, or candidate, or identified sensitive species and waterways.
- Guideline: Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.
- Guideline: Constraints (e.g., maximum limit to which water level can be drawn down or minimum distance from a connected river, stream, wetland, or groundwater-dependent ecosystem) should be established for new groundwater pumping sites permitted on NFS lands in order to protect the character and function of water resources.
- Guideline: Wet meadows and cienegas should not be used for concentrated activities (e.g., equipment storage, forest product or mineral stockpiling, livestock handling facilities, special uses) that cause damage to soil and vegetation.
- Guideline: Rare, unique habitats (e.g., talus slopes, cliffs, canyon slopes, caves, fens, bogs, sinkholes) should be protected.

Other plan decisions would also help provide for the needs of the Three Forks springsnail. The recommended Three Forks Research Natural Area would afford additional protection by precluding livestock grazing, timber production, new motorized roads, trails, and temporary roads in the Three Forks area where the snail has occurred. This would include the canyon reaches of North and East Forks Black River and Boneyard Creek drainages where the snail is found.

Besides the overall alternative comparisons above, comparison of PNVTs providing habitat are included for the Three Forks springsnail. For both the wetland/cienega riparian PNVT and the montane will riparian forest PNVT, movement toward desired conditions is greatest under **alternatives B and D**, and least under **alternatives A and C**.

Desired conditions and objectives included for **alternative B** would help improve habitat for the snail by promoting restoration of watershed and riparian areas, and by incorporating recovery actions and strategies for federally listed species. While standards and guidelines would help reduce short-term plan implementation impacts, not all potential negative effects (e.g. water quality, vegetation trampling) would be precluded. As such, the biological assessment determined that **alternative B may affect and is likely to adversely affect** the Three Forks springsnail.

Plan components help provide for primary constituent elements of critical habitat such as needed spring runs and substrates, and limited presence of predators. However, the extent to which standards and guidelines reduce or eliminate plan implementation impacts cannot be considered insignificant or discountable. As such, the biological assessment determined that **alternative B may affect and is likely to adversely affect** critical habitat for the Three Forks springsnail.

Climate and cumulative effects: Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation, possibly reducing water in riparian zones (Forest

Service, 2010b) and result in the loss of spring-runs needed by the Three Forks springsnail. However, the unique springs that support this species may also be impacted by groundwater pumping. There is one well located on private land adjacent to Boneyard Bog and upstream of the occupied springsnail sites along Boneyard Creek. In addition, elk wallowing and trampling is common at Three Forks and Boneyard Bog in the spring and early summer.

Mexican Wolf: Experimental, Nonessential Population

Alternative A: See above.

Alternatives B, C, and D:

The **action alternatives** provide objectives, desired conditions, standards, or guidelines favorable for the Mexican wolf. Some examples of key plan components that address the needs of this species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Large blocks of habitat are interconnected, allowing for behavioral and predator-prey interactions, and the persistence of metapopulations and highly interactive wildlife species across the landscape.
- Desired Condition: Wildlife are free from harassment and disturbance at a scale that impacts vital functions (e.g., breeding, rearing young) that could affect persistence of the species.
- Desired Condition: Herbaceous vegetation amount and structure (e.g., plant density, height, litter, seed heads) provides habitat to support wildlife and prey species.
- Desired Condition: Vegetation conditions provide hiding and thermal cover in contiguous blocks for wildlife. Native plant species are present in all age (size/canopy) classes and are healthy, reproducing, and persisting.
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Standard: Motorized vehicle travel shall be managed to occur only on the designated system of NFS roads and motorized trails and designated motorized areas.
- Guideline: Firelines, helispots, and fire camps should be located to avoid disturbance to critical species and impacts to cultural resources.
- Guideline: Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions.
- Guideline: Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to retain or allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- Guideline: Forage, browse, and cover needs of wildlife, authorized livestock, and wild horses should be managed in balance with available forage so that plants providing these needs remain at or move toward a healthy, persistent condition
- Guideline: Activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from recovery plans.

Other plan decisions would help provide for the Mexican wolf. Management areas where motorized vehicle use is restricted or prohibited reduce the wolf’s exposure to loss from vehicles or illegal activities. Management areas providing more secure habitat for the wolf and its prey include wildlife quiet areas, wilderness, recommended wilderness, and the primitive area.

Regardless of the overall alternative comparisons above, wolves are not PNVT habitat specialists. Relative to disturbance to wolves or their prey or harm to wolves, **alternative D** would provide the greatest amount of secure habitat for the Mexican wolf, followed by **alternative B**, then **alternative C**, and finally **alternative A**.

Desired conditions and objectives included in alternative B would help improve habitat for species that provide wolf prey and would help benefit wolves by incorporating recovery actions and strategies for federally listed species. Standards and guidelines would help to reduce short-term plan implementation impacts (e.g., disturbance). As such, the biological assessment determined that **alternative B would not likely jeopardize** the continued existence of this experimental, non-essential population of Mexican wolves.

Climate and cumulative effects: Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation (Forest Service, 2010b). The changes could potentially affect wolf prey populations, although how substantially is not known at this time. Factors outside Forest Service control that may affect Mexican wolves include AZGFD objectives for elk and deer populations in game management units across the forests.

New Mexico Meadow Jumping Mouse: Endangered with Proposed Critical Habitat

Alternative A: See above.

Alternatives B, C, and D: The action alternatives provide objectives, desired conditions, standards, and guidelines favorable for the New Mexico meadow jumping mouse. Some examples of key plan components addressing the needs of this species and its critical habitat include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Desired Condition: Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of native and desirable nonnative plants and animals that are healthy, well distributed, connected, and genetically diverse. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the landscape.
- Desired Condition: Habitat and ecological conditions are capable of providing for self-sustaining populations of native, riparian dependent plant and animal species.
- Desired Condition: Riparian obligate species within wet meadows, along stream banks, and active floodplains provide sufficient vegetative ground cover (herbaceous vegetation and litter cover) to protect and enrich soils, trap sediment, mitigate flood energy, stabilize stream banks, and provide for wildlife and plant needs.
- Standard: Aerial retardant drops should avoid threatened, endangered, proposed, or candidate, or identified sensitive species and waterways.
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Standard: Streams on NFS lands with high aquatic values and at risk from new water diversions shall be preserved and protected with instream flow water rights.

- Standard: Motorized vehicle travel shall be managed to occur only on the designated system of NFS roads and motorized trails and designated motorized areas
- Guideline: Critical areas [e.g., riparian areas] should be managed to address the inherent or unique site factors, condition, values, or potential conflicts.
- Guideline: Landscape scale restoration projects should be designed to spread treatments out spatially and/or temporally within the project area to reduce implementation impacts and allow reestablishment of vegetation and soil cover.
- Guideline: Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.
- Guideline: Roads and motorized trails should be designed and located so as to not impede terrestrial and aquatic species movement and connectivity.
- Guideline: Streambed and floodplain alteration or removal of material should not occur if it prevents attainment of riparian, channel morphology, or streambank desired conditions.
- Guideline: Dispersed campsites should not be located on or adjacent to archaeological sites or sensitive wildlife areas.
- Guideline: Activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from recovery plans.

Besides the overall alternative comparisons above, comparison of PNVTs providing habitat are included for the New Mexico meadow jumping mouse. For both the montane willow and cottonwood-willow riparian forested PNVTs, movement toward desired conditions is greatest under **alternatives B and D**, and least under **alternatives A and C**.

Desired conditions and objectives included for alternative B would help improve mouse habitat by promoting restoration of upland and riparian PNVTs and watersheds, and by incorporating recovery actions and strategies for federally listed species. While standards and guidelines help reduce short-term plan implementation impacts, not all potential negative effects (e.g. roads, scouring floods) would be precluded. As such, the biological assessment determined that **alternative B may affect and is likely to adversely affect** the New Mexico meadow jumping mouse.

Plan components help provide for proposed primary constituent elements of critical habitat such as flowing water, saturated soils, tall stubble height of vegetation, sufficient space or length of riparian areas, and floodplains and adjacent uplands extending to 100 meters (330 feet) from bankfull water's edge. The biological assessment determined that **alternative B would not likely result in adverse modification** of proposed critical habitat for the mouse. However, standards and guidelines would not preclude all short-term plan implementation impacts. As such, the biological assessment also determined that plan implementation under **alternative B may affect and is likely to adversely affect critical habita**t, if listed, for the New Mexico meadow jumping mice.

Climate and cumulative effects: Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation, consequently reducing water in riparian zones (Forest Service, 2010b) and potentially reducing the riparian and saturated soil habitat needed by the New Mexico meadow jumping mouse. There is one 5-acre private land parcel in upper Campbell Blue Creek that has an older house, although the site could be further developed. Habitat for the mouse occurs within or adjacent to private land on Nutrioso and Campbell Blue Creeks and on the San Francisco River in the Alpine Valley. Private land impacts include home site, livestock grazing and facilities, wells, and septic systems.

Lesser Long-nosed Bat: Endangered

Alternative A: See above.

Alternatives B, C, and D: The action alternatives provide objectives, desired conditions, standards, and guidelines favorable for the lesser long-nosed bat. Some key plan components addressing the needs of this species include the following:

- Desired Condition: Habitat conditions contribute to the recovery of federally listed species.
- Standard: Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
- Guideline: Landscape scale restoration projects should be designed to spread treatments out spatially and/or temporally within the project area to reduce implementation impacts and allow reestablishment of vegetation and cover.
- Guideline: Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives.
- Guideline: Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- Guideline: Caves and abandoned mines that are used by bats should be managed to prevent disturbance to species and spread of disease (e.g., white-nose syndrome).

Besides the overall alternative comparisons above, comparisons of individual PNVTs providing habitat for lesser long-nosed bat are included. For the semi-desert grassland PNVT, movement toward desired conditions is greatest for alternatives B and D, and least under **alternatives A and C**. For the Madrean pine-oak woodland PNVT, movement toward desired conditions is greatest under **alternative D**, followed by **alternatives B and C**, with the least under alternative A.

Standards and guidelines would help to reduce short-term plan implementation impacts (e.g., burning, grazing); however, the bat is not known or expected to occur on the Apache-Sitgreaves NFs at this time. As such, the biological assessment determined that **alternative B** would have no effect on the lesser long-nosed bat.

Climate and cumulative effects: Research potentially warmer and drier conditions(Forest Service, 2010b). This may result in an expansion of the semi-desert grassland and Madrean pine-oak woodland on the forests and associated food plants for species such as the lesser long-nosed bat. On the other hand, potential expansion of the Freeport-McMoRan open-pit mine near Morenci would remove habitat acres currently providing foraging plants that could potentially be used by this species. The lesser long-nosed bat may be cumulatively impacted by livestock grazing, wildland fire and other activities on State and private lands in the southern half of Arizona.

Sensitive Species

Sensitive species are designated because of concerns about trends in population or habitat capability (Forest Service Manual 2670.5). As previously noted, **all alternatives** provide species viability to varying levels of effectiveness. The viability discussion for the 53 Regional Forester sensitive species identified as forest planning species is organized by coarse filter PNVTs and fine filter habitat elements to facilitate alternative comparison. Determinations are made for sensitive species relative to impacts to individuals and potential trend toward Federal listing (Forest Service Handbook 2670.32).

Viability risk ratings for sensitive species as FPS are included in table 80. The management effect, as a reflection of plan objectives for each alternative, is shown for the habitats associated with sensitive species in table 77. Sections of the plan that contain plan components (decisions) relative to sensitive species at the coarse and fine filter are shown in table 87 below. Some key plan components (decisions) that help meet the needs of sensitive species are noted in the following species across habitat discussions.

For more information, appendix G contains a crosswalk on how individual species' needs are met by various plan components (decisions). In addition, the "Wildlife Specialist Report – Viability" contains a complete list of plan decisions relative to sensitive species (e.g., desired conditions, standards, guidelines). The "Draft Biological Evaluation" (Forest Service, 2014aa) contains more detail on analysis of sensitive species.

Table 87. Sections of the plan containing plan decisions that address sensitive species at the coarse and fine filter levels

Viability/Plan Decision	Desired Conditions	Standards	Guidelines
Coarse filter plan decisions that provide viability for: All Sensitive Species	Riparian Areas, All PNVTs, Ponderosa Pine, Dry Mixed Conifer, Wet Mixed Conifer, Piñon-Juniper, Madrean Pine-Oak, Grasslands, Interior Chaparral		
Fine filter plan decisions in addition to the coarse filter plan decisions above that provide viability for: Ponderosa Pine Forest Sensitive Species: Mogollon vole, Merriam's shrew, four-spotted skipperling butterfly, Arizona sneezeweed, Mogollon clover			Ponderosa Pine, Wildlife and Rare Plants
Dry Mixed Conifer Forest Sensitive Species: Goodding's onion, Merriam's shrew			Dry Mixed Conifer, Wildlife and Rare Plants
Wet Mixed Conifer Forest Sensitive Species: White Mountains chipmunk, southern red-backed vole			Soil, Wildlife and Rare Plants
Madrean Pine-Oak Woodland Sensitive Species: Greene milkweed			All PNVTs, Wildlife and Rare Plants

Viability/Plan Decision	Desired Conditions	Standards	Guidelines
Montane/Subalpine Grasslands Sensitive Species: Ferris' copper butterfly, nitocris and nakomis fritillary butterflies, dwarf shrew, long-tailed vole, White Mountains ground squirrel			All PNVTs, Wildlife and Rare Plants
Great Basin Grassland Sensitive Species: Springerville pocket mouse, White Mountains ground squirrel, Greene milkweed, Parish alkali grass			All PNVTs, Wildlife and Rare Plants
High Water Quality Sensitive Species: water shrew, bald eagle, northern leopard frog, northern Mexican gartersnake, narrow-headed gartersnake, California floater			Water Resources, Riparian Areas, Wildlife and Rare Plants, Wild Horse TerritoryManagement Area
Unique Habitat Sensitive Species (Healthy Riparian Conditions): Water shrew, New Mexico meadow jumping mouse, northern Mexican gartersnake, narrow-headed gartersnake, Arizona willow, Bebb willow		Dispersed Recreation	Water Resources, Aquatic Habitat and Species, Riparian Areas, Wildlife and Rare Plants, Livestock Grazing
Unique Habitat Sensitive Species (Large Trees/Snags, Dense Canopies): Allen's big-eared bat, bald eagle			Wildlife and Rare Plants
Unique Habitat Sensitive Species (Dense Low-Mid Canopy with Ample Ground Litter): western red bat		Dispersed Recreation	Wildlife and Rare Plants, Motorized Opportunities
Unique Habitat Sensitive Species (Permanent Wet Meadow-Like Areas): Ferris' copper butterfly, nitocris fritillary butterfly, nokomis fritillary butterfly			Wildlife and Rare Plants

Consequences to Coarse Filter Species

Sensitive Species Across All Habitats

The following 24 sensitive species (from table 80) have essentially no risk to viability from any of the alternatives because desired conditions for their associated PNVT would meet their needs. Modeling has shown **all alternatives** move habitat toward those conditions at 15 years regardless of alternative management effect. In addition, most alternatives continue toward desired conditions at 50 years (**alternative C** is the primary exception, see table 79).

While there may be some impact to individuals from implementation of any of the plan alternatives, there would be no trend toward Federal listing for the following sensitive species during the planning period under **all alternatives**:

> Townsend's big-eared bat, spotted bat, greater western mastiff bat, Arizona montane vole, Arizona gray squirrel, red squirrel, northern goshawk, zone-tailed hawk, common black-hawk, yellow-billed cuckoo, gray catbird, peregrine falcon, gray vireo, Arizona toad, lowland leopard frog, Arizona snaketail dragonfly, White Mountains paintbrush, Arizona sunflower, Eastwood alumroot, Arizona alumroot, heathleaf ragwort, Davidson's cliff carrot, Blumer's dock, and carnivorous bladderwort.

Consequences to Fine Filter Species

Viability for the remaining 29 sensitive species is provided by fine filter habitat elements with consideration for alternative management effect. For the analysis, fine filter sensitive species discussed below are grouped by PNVTs and by habitat elements.

In order to compare the viability effectiveness among alternatives, the viability risk rating (VRR) outcomes for each species (table 80) are combined with the overall PNVT management effect (ME) outcomes in terms of how the alternative's objectives move habitat toward desired conditions (table 79). This involves converting viability risk values and management effect values into a common descriptor so they can be combined.

Management effects (ME) outcomes are converted and shown in the following PNVT tables: ME of 1 as "+++"; ME 2 as "++"; and ME 3 as "+." See table 65 for descriptions of each management effect.

Viability risk rating outcomes (VRR) are converted and described in table 88 below. VRRs of L or M are shown in the following PNVT tables as "+++" because risks are considered no more substantial than normal ecosystem fluctuations, therefore providing for viability. The VRR of MH is expressed in the tables below as "++" because this rating is best in terms of providing for viability effectiveness as compared to the VRR of H which is expressed as "+" (based on the analysis, there is no rating of VH). The above viability risk ratings and how they relate to viability are shown in table 88 below.

Table 88. Viability risk ratings described and converted

Risk Levels	Species Persistence	Viability	Levels of Viability Effectiveness
Normal ecosystem fluctuations →	Species able to adjust and persistence →	Yes	(Natural)
VRRs of L and M →	Species able to adjust and persistence because risk is similar to normal ecosystem fluctuations →	Yes →	L or M = +++

Risk Levels	Species Persistence	Viability	Levels of Viability Effectiveness
VRRs of MH, H, VH →	Species persists based on fine filter guidelines →	Yes (alternatives providing viability at various effectiveness levels for comparison of alternatives) →	Viability effectiveness: MH = ++ best H = + next best VH = (no occurrences)

All plan components relevant to sensitive species are listed in the "Wildlife Specialist Report – Biological Evaluation." In addition, appendix G lists all standards and guidelines addressing sensitive and other wildlife species needs.

Ponderosa Pine Forest PNVT Sensitive Species

Mogollon vole, Merriam's shrew, four-spotted skipperling butterfly, Arizona sneezeweed, Mogollon clover

These sensitive species have a fine filter habitat need of sometimes shaded or often wet meadows or forest openings. These conditions provide insect and invertebrate prey for the vole and shrew, moister conditions for nectaring for the butterfly, and cooler growing conditions for the two plants. Desired conditions for this PNVT address openings and meadows; however, additional plan components are included to ensure their needs are met:

- Ponderosa Pine Guideline – Where consistent with project or activity objectives, canopy cover should be retained on the south and southwest sides of small, existing forest openings that are naturally cooler and moister. These small (generally one-tenth to one-quarter acre) shaded openings provide habitat conditions needed by small mammals, plants, and insects (e.g., Merriam's shrew, Mogollon clover, four-spotted skipperling butterfly). Where these openings naturally occur across a project area, these conditions should be maintained on an average of two or more such openings per 100 acres.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 89 compares the viability effectiveness of the alternatives. **Alternatives B and D** would have the greatest viability effectiveness for these ponderosa pine forest species, followed by **alternative C**, then **alternative A**.

Individuals of these five species may be impacted by implementation of any of the alternatives, which may be more likely under **alternative A** with its lower overall viability effectiveness (13) as compared to the **action alternatives** (21, 16, 21 respectively for **alternatives B, C, and D**). However, **none of the alternatives** would lead to a trend toward Federal listing. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the "Vegetation" section) and the guidelines above additionally provide for these species' needs.

Table 89. Viability effectiveness for ponderosa pine forest sensitive species

Sensitive FPS Associated with Ponderosa Pine Forest	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Mogollon vole	+ + +	+ + +	+ +	+ + +
Fine filter - Merriam's shrew	+ +	+ + +	+ + +	+ + +
Fine filter - Four-spotted skipperling butterfly	+ + +	+ + +	+ +	+ + +
Fine filter - Arizona sneezeweed	+	+ + +	+ + +	+ + +
Fine filter - Mogollon clover	+ +	+ + +	+ + +	+ + +
Coarse filter - ME	+ +	+ + +	+ + +	+ + +
Total effectiveness +'s	13	21	16	21

Dry Mixed Conifer Forest PNVT Sensitive Species

Goodding's onion, Merriam's shrew

Goodding's onion has a fine filter habitat need for cool forested, understory microclimate sites (it is rhizomatous and grows in clusters under trees). Because desired conditions for forest structure and density are similar to ponderosa pine forest (more open canopies), the following guideline is included to ensure its more shaded needs are met:

- Wildlife and Rare Plants Guideline – Cool and/or dense vegetation cover should be provided for species needing these habitat components (e.g., Goodding's onion, black bear, White Mountains chipmunk, western yellow-billed cuckoo).

Merriam's shrew has a fine filter habitat need for wet meadows and forest openings which provide the terrestrial insects, worms and other invertebrates the shrew preys upon. Because desired conditions for forest structure and density are similar to ponderosa pine forest (more open canopies), the following guidelines are included to ensure its needs are met:

- Dry Mixed Conifer Guideline – Where consistent with project or activity objectives, canopy cover should be retained on the south and southwest sides of small, existing forest openings that are naturally cooler and moister. These small (generally one-tenth to one-quarter acre) shaded openings provide habitat conditions needed by small mammals, plants, and insects (e.g., Merriam's shrew, Mogollon clover, four-spotted skipperling butterfly). Where these openings naturally occur across a project area, these conditions should be maintained on an average of two or more such openings per 100 acres.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 90 compares the viability effectiveness of the alternatives. **Alternatives B and D** would provide the greatest viability effectiveness for these dry mixed conifer forest sensitive species, followed by **alternative C**, then **alternative A**.

Individuals of these two dry mixed conifer forest sensitive species may be impacted by implementation of any of the alternatives, which may be more likely under **alternative A**.

However, **none of the alternatives** would lead to a trend toward Federal listing. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the “Vegetation” section) and the guidelines above additionally provide for these species’ needs.

Table 90. Viability effectiveness for dry mixed conifer forest sensitive species

Sensitive FPS Associated with Dry Mixed Conifer Forest	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Goodding’s onion	+ + +	+ + +	+ +	+ + +
Fine filter - Merriam’s shrew	+ +	+ + +	+ + +	+ + +
Coarse filter - ME	+ +	+ + +	+ + +	+ + +
Total effectiveness +’s Coupled with ME	7	9	8	9

Wet Mixed Conifer Forest and Spruce-Fir Forest PNVTs Sensitive Species

White Mountains chipmunk, southern red-backed vole

These two sensitive species need ample litter and down debris (logs). Decaying logs provide fungi that both species feed upon, while litter provides insects, invertebrates, and cover for the vole. Guidelines that contribute to these needs follow:

- Soil Guideline – Coarse woody debris retention and/or creation should be used as needed to help retain long-term soil productivity.
- Wildlife and Rare Plants Guideline – Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 91 compares the viability effectiveness of the alternatives (identical for both PNVTs). **Alternative D** would provide the greatest viability effectiveness for wet mixed conifer forest sensitive species as compared to **alternatives A, B, and C**, but all are similar. Individuals of these two species may be impacted by implementation of any of the alternatives. However, **none of the alternatives** would lead to a trend toward Federal listing. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions in wet mixed conifer forest (see the “Vegetation” section) and the guidelines above additionally provide for these species’ needs.

Table 91. Viability effectiveness for wet mixed conifer forest and spruce-fir forest sensitive species

Sensitive FPS Associated with Wet Mixed Conifer Forest				
Fine filter - White Mountains chipmunk	+ +	+ + +	+ + +	+ + +

Sensitive FPS Associated with Wet Mixed Conifer Forest	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Southern red-backed vole	+ + +	+ +	+ +	+ + +
Coarse filter - ME	+ +	+ + +[a]	+ + +[a]	+ + +[a]
Total effectiveness +'s Coupled with ME	**7**	**8**	**8**	**9**

[a] ME for spruce-fir forest under alternatives B, C, and D is like alternative A, i.e., ++ ; however, it does not change the relative viability effectiveness of the alternatives.

Madrean Pine-Oak Woodland PNVT Sensitive Species

Greene milkweed

This rare species can be impacted by fire and livestock use so providing a fine filter habitat need for adjacent untreated areas helps ensure conditions free of these risks are available in some locations across the landscape of this PNVT. The following guidelines are included to ensure its needs are met:

- All PNVTs Guideline – Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- Wildlife and Rare Plants Guideline – Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 92 compares the viability effectiveness of the alternatives. **Alternatives B and D** would have the greatest viability effectiveness, followed by **alternative C**, then **alternative A**.

Individuals of this species may be impacted by implementation of the alternatives which may be more likely under **alternatives A and C** as compared to **alternatives B and D**. However, **none of the alternatives** would lead to a trend toward Federal listing. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the "Vegetation" section) and the guidelines above provides for these species' needs.

Table 92. Viability effectiveness for Madrean pine-oak woodland sensitive species

Sensitive FPS Associated with Madrean pine-oak woodland	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Greene milkweed	+	+ + +	+ +	+ + +
Coarse filter - ME	+	+ + +	+ +	+ + +
Total effectiveness +'s Coupled with ME	2	6	4	6

Montane/Subalpine Grasslands PNVT Sensitive Species

Ferris' copper butterfly, nitocris and nokomis fritillary butterflies, dwarf shrew, long-tailed vole, White Mountains ground squirrel

The sensitive butterfly species utilize seasonally wetted swales which provide nectaring plants and damp sites for minerals.

The three mammals do not move great distances and the squirrel nests underground. These areas provide small invertebrate prey for the shrew and seeds and plant material for the vole and ground squirrel. Providing a fine filter habitat need for adjacent untreated areas helps ensure conditions are available in some locations across the landscape of this PNVT for these species.

The following plan components are included to ensure that all these species needs are met:

- All PNVTs Guideline – Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- All PNVTs Guideline – Landscape scale restoration projects should be designed to spread treatments out spatially and/or temporally within the project area to reduce implementation impacts and allow reestablishment of vegetation and soil cover.
- Wildlife and Rare Plants Guideline– Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 93 compares the viability effectiveness of the alternatives. **Alternatives B, C, and D** would have the greatest viability effectiveness for these montane/subalpine grasslands sensitive species as compared to **alternative A**.

Individuals of these species may be impacted by implementation of any of the alternatives which may be more likely under **alternative A**. However, **none of the alternatives** would lead to a trend toward Federal listing because viability has been provided by each alternative. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the "Vegetation" section) and the guidelines above additionally provide for these species' needs.

Table 93. Viability effectiveness for montane/subalpine grasslands sensitive species

Sensitive FPS Associated with MSG	Viability Effectiveness (coarse and fine filter)			
	Alt. A	Alt. B	Alt. C	Alt. D
Fine Filter - Ferris' copper butterfly	+ +	+ + +	+ + +	+ + +
Fine Filter - Nitocris fritillary butterfly	+ +	+ + +	+ + +	+ + +
Fine Filter - Nakomis fritillary butterfly	+ +	+ + +	+ + +	+ + +
Fine Filter - Dwarf shrew	+ +	+ + +	+ + +	+ + +

Sensitive FPS Associated with MSG	Viability Effectiveness (coarse and fine filter)			
	Alt. A	Alt. B	Alt. C	Alt. D
Fine Filter - Long-tailed vole	+ +	+ + +	+ + +	+ + +
Fine Filter - White Mountains ground squirrel	+ +	+ + +	+ + +	+ + +
Coarse filter - ME	+	+ + +	+ +	+ + +
Total effectiveness +'s Coupled with ME	**13**	**21**	**20**	**21**

Great Basin Grassland PNVT Sensitive Species

Springerville pocket mouse, White Mountains ground squirrel, Greene milkweed, Parish alkali grass

The two small mammals do not move great distances. These areas provide forage in plants and roots for the vole and squirrel. The milkweed can be impacted by fire and livestock use; the grass is highly localized on alkali wet meadows or drainages. Providing a fine filter habitat need for adjacent untreated areas helps ensure conditions for both plants are available in some locations across the landscape of this PNVT. The following guidelines are included to ensure needs of these species are met:

- All PNVTs Guideline – Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- All PNVTs Guideline – Landscape scale restoration projects should be designed to spread treatments out spatially and/or temporally within the project area to reduce implementation impacts and allow reestablishment of vegetation and soil.
- Wildlife Guideline – Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives.
- Wildlife and Rare Plants Guideline – The needs of localized species (e.g., New Mexico meadow jumping mouse, Bebb willow, White Mountains paintbrush) should be considered and provided for during project activities to ensure their limited or specialized habitats are not lost or degraded.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 94 compares the viability effectiveness of the alternatives. **Alternatives B and D** would provide the greatest viability effectiveness followed by **alternatives C and A**.

Individuals of these three species may be impacted by implementation of any of the alternatives which may be more likely under **alternative A**. However, **none of the alternatives** would lead to a trend toward Federal listing because viability has been provided by each alternative. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the "Vegetation" section) and the guidelines above additionally provide for these species' needs.

Table 94. Viability effectiveness for Great Basin grassland sensitive species

Sensitive FPS Associated with Great Basin grassland	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Springerville pocket mouse	+ +	+ + +	+ + +	+ + +
Fine filter - White Mountains ground squirrel	+ +	+ + +	+ + +	+ + +
Fine filter - Parish alkali grass	+ +	+ + +	+ + +	+ + +
Coarse filter - ME	+	+ + +	+	+ + +
Total effectiveness +'s Coupled with ME	7	12	10	12

Semi-Desert Grassland PNVT Sensitive Species

There are no sensitive species within the semi-desert grassland that have additional fine filter habitat needs.

High Water Quality Sensitive Species

Water shrew, bald eagle, northern leopard frog, northern Mexican gartersnake, narrow-headed gartersnake, California floater

All of these sensitive species are found within the various riparian PNVTs and require high water quality. High water quality is necessary for their breathing and/or feeding and reproduction—for either themselves or their prey. Because these species occur across PNVTs, desired conditions from other resource areas that contribute to their viability as well as fine filter standards and guidelines are listed below:

- Water Resources Desired Condition – Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances.
- Water Resources Desired Condition – Vegetation and soil conditions above the floodplain protect downstream water quality, quantity, and aquatic habitat.
- Water Resources Desired Condition – Water quality meets the needs of desirable aquatic species such as the California floater, northern and Chiricahua leopard frogs, and invertebrates that support fish populations.
- Aquatic Habitat and Species Desired Condition – Streamflows, habitat, and water quality support native aquatic and riparian dependent species and habitat.
- Water Resources Guideline – To protect water quality and aquatic species, heavy equipment and vehicles driven into a water body to accomplish work should be completely clean of petroleum residue. Water levels should be below the gear boxes of the equipment in use. Lubricants and fuels should be sealed such that inundation by water shall not result in leaks.

- Water Resources Guideline – Streams, stream banks, shorelines, lakes, wetlands, and other bodies of water should be protected from detrimental changes in water temperature and sediment to protect aquatic species and riparian habitat.
- Riparian Area Guideline – Storage of fuels and other toxicants should be located outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
- Riparian Area Guideline – Equipment should be fueled or serviced outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 95 compares the viability effectiveness of the alternatives. **Alternative B** would provide the greatest viability effectiveness for these high water quality sensitive species as compared to **alternatives A, C, and D** which are similar.

Individuals of these species may be impacted by implementation of any of the alternatives. However, **none of the alternatives** would lead to a trend toward Federal listing because viability has been provided by each alternative. This is because alternative objectives (table 3) are expected to move habitat toward desired conditions (see the “Vegetation” section) and the guidelines above additionally provide for these species’ needs.

Table 95. Viability effectiveness for high water quality sensitive species

Sensitive FPS associated with high water quality	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Water shrew	+ +	+ + +	+ + +	+ + +
Fine filter - Bald eagle	+ + +	+ + +	+ + +	+ + +
Fine filter - Northern leopard frog	+ + +	+ + +	+ + +	+ +
Fine filter - Northern Mexican gartnersnake	+ +	+ + +	+ +	+ + +
Fine filter - Narrow-headed gartersnake	+ +	+ + +	+ +	+ + +
Fine filter - California floater	+ + +	+ + +	+ + +	+ +
Coarse filter - ME	+ + +	+ + +	+ + +	+ +
Total effectiveness +'s Coupled with ME	18	21	19	18

Unique Habitat Sensitive Species (Healthy Riparian Conditions)

Water shrew, New Mexico meadow jumping mouse, northern Mexican gartersnake, narrow-headed gartersnake, Arizona willow, Bebb willow

All of these sensitive animals forage and hunt within the riparian zone. All require tall, dense, untrampled vegetation for cover; the shrew and mouse for hiding cover from predators and the snakes for hunting cover and prey habitat. The willows need saturated, uncompacted soils, and protection from ungulate grazing in the spring and early summer. The following guidelines, standard, and objective help provide for their needs:

- Riparian Areas Objective – Annually, work with partners to reduce animal damage to native willows and other riparian species on an average of 5 miles of riparian habitat (**alternatives B, C, and D**).
- Water Resources Guideline – Streams, stream banks, shorelines, lakes, wetlands, and other bodies of water should be protected from detrimental changes in water temperature and sediment to protect aquatic species and riparian habitat.
- Aquatic Habitat and Species Guideline – Sufficient water should be left in streams to provide for aquatic species and riparian vegetation.
- Riparian Areas Guideline – Ground-disturbing projects (including prescribed fire) which may degrade long-term riparian conditions should be avoided.
- Riparian Areas Guideline – Active grazing allotments should be managed to maintain or improve to desired riparian conditions.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.
- Dispersed Recreation Standard – Dispersed campsites shall not be designated in areas with sensitive soils or within 50 feet of streams, wetlands, or riparian areas to prevent vegetation and bank damage, soil compaction, additional sediment, or soil and water contamination.
- Livestock Grazing Guideline – Critical areas (e.g., riparian areas) should be managed to address the inherent or unique site factors, condition, values, or potential conflicts.

- Livestock Grazing Guideline – New livestock troughs, tanks, and holding facilities should be located out of riparian areas to reduce concentration of livestock in these areas. Existing facilities in riparian areas should be modified, relocated, or removed where their presence is determined to inhibit movement toward desired riparian or aquatic conditions.
- Livestock Grazing Guideline – To prevent resource damage (e.g., stream banks) and disturbance to federally listed and sensitive wildlife species, trailing of livestock should not occur along riparian areas. Where no alternative route is available, approval may be granted where effective mitigation measures are implemented (e.g., timing of trailing, number of livestock trailed at one time).
- Wildlife and Rare Plants Guideline – Measures (e.g., fencing, planting/translocation, research) should be implemented to help ensure regional forester identified sensitive species do not trend toward Federal listing.

Table 96 compares the viability effectiveness of the alternatives. **Alternatives B and D** would provide the greatest viability effectiveness as compared to **alternatives A and C**. This is because of differences in treatment objectives. Restoration objectives for desired riparian composition, structure, and function are only on an “opportunity basis” under **alternatives A and C**. Treatments to restore desired conditions under **alternatives B and C** range from 200 to 600 acres per year. In addition, **alternative A** would not include working with partners to reduce animal damage to native riparian species.

Table 96. Viability effectiveness for healthy riparian sensitive species

Sensitive FPS Associated with High Water Quality	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Water shrew	+ +	+ + +	+ +	+ + +
Fine filter - NM meadow jumping mouse	+ +	+ + +	+ +	+ + +
Fine filter - Northern Mexican gartnersnake	+ +	+ + +	+ +	+ + +
Fine filter - Narrow-headed gartersnake	+ +	+ + +	+ +	+ + +
Fine filter - Arizona willow	+ +	+ + +	+ + +	+ + +
Fine filter - Bebb willow	+ +	+ + +	+ + +	+ + +
Coarse filter - ME	+ +	+ + +	+ +	+ + +
Total effectiveness +’s Coupled with ME	**14**	**21**	**16**	**21**

Individuals of these species may be impacted by implementation of any of the alternatives. However, **none of the alternatives** would lead to a trend toward Federal listing because viability has been provided by each alternative. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the “Vegetation” section) and the above guidelines and other plan components additionally provide for these species’ needs.

Unique Habitat Sensitive Species (Large Trees/Snags, Dense Canopies)

Allen's big-eared bat, bald eagle

Maternity colonies of Allen's big-eared bats are found in boulder piles, crevices, and beneath the bark of large ponderosa pine snags. The bald eagle has a habitat need for tall, healthy, and strong trees to build nests in. These may be riparian trees like cottonwood or forested PNVT trees near water. Bald eagles have nested in a very large ponderosa pine near Luna Lake since 1993 and in large Douglas-fir trees near Crescent Lake since 2007. Breeding, incubating, and young rearing eagles are especially sensitive to disturbance. Desired conditions from different PNVTs that contribute to their viability as well as fine filter guidelines are listed:

- All PNVTs Desired Condition – Old or large trees, multistoried canopies, large coarse woody debris, and snags provide the structure, function, and associated vegetation composition as appropriate for each forested and woodland PNVT.
- Riparian Areas Desired Condition – Vegetation is structurally diverse, often dense, providing for high bird species diversity and abundance, especially neotropical migratory birds. It includes large trees and snags in the cottonwood-willow and mixed broadleaf deciduous riparian forests to support species such as beaver, yellow-billed cuckoo, bald eagle, Arizona gray squirrel, and various bat species.
- Wildlife and Rare Plants Guideline – Any action likely to cause a disturbance and take to bald and golden eagles in nesting and young rearing areas should be avoided per the Bald and Golden Eagle Protection Act.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 97 compares the viability effectiveness of the alternatives. **Alternative D** provides somewhat greater viability effectiveness, followed by **alternatives A and B,** then **alternative C**. Individual Allen's big-eared bats may be impacted by implementation of any of the alternatives. Individual bald eagles could not be impacted by implementation of any alternative unless a permit for limited, non-purposeful take of bald eagles (and golden eagles) is issued by the USFWS.

Table 97. Viability effectiveness for large tree sensitive species

Sensitive FPS Associated with High Water Quality	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Allen's big-eared bat	+ + +	+ +	+ +	+ + +
Fine filter - Bald eagle	+ + +	+ + +	+ + +	+ + +
Coarse filter - ME	+ +	+ + +	+ +	+ + +
Total effectiveness +'s Coupled with ME	**8**	**8**	**7**	**9**

However, **none of the alternatives** would lead to a trend toward Federal listing for these two sensitive species because viability has been provided by each alternative. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the "Vegetation" section), and the guidelines above additionally provide for these species' needs.

Unique Habitat Sensitive Species (Dense Low-Mid Canopy with Ample Ground Litter)

Western red bat

The western red bat is the only sensitive species in this category. On the forests, it is associated primarily with the MBDRF, needing dense canopy for roosting. It is thought this bat burrows into leaf litter or dense grass during hibernation. Desired conditions from other resource areas that contribute to the viability of this species as well as fine filter standards and guidelines are listed below:

- All PNVTs Desired Condition – Old or large trees, multistoried canopies, large coarse woody debris, and snags provide the structure, function, and associated vegetation composition as appropriate for each forested and woodland PNVT.
- Riparian Areas Desired Condition – Natural ecological disturbances (e.g., flooding, scouring) promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all ages and size classes necessary for the recruitment of riparian dependent species.
- Riparian Areas Desired Condition – Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.
- Riparian Areas Desired Condition – Active grazing allotments should be managed to maintain or improve to desired riparian conditions.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.
- Dispersed Recreation Standard – Dispersed campsites shall not be designated in areas with sensitive soils or within 50 feet of streams, wetlands, or riparian areas to prevent vegetation and bank damage, soil compaction, additional sediment, or soil and water contamination.
- Motorized Opportunities Guideline – As projects occur in riparian or wet meadow areas, unneeded roads or motorized trails should be closed or relocated, drainage restored, and native vegetation reestablished to move these areas toward their desired condition.

Table 98 compares the viability effectiveness of the alternatives. **All alternatives** have nearly the same viability effectiveness, with **alternative C** providing slightly less viability effectiveness. Individual red bats may be impacted by any alternative. However, **none of the alternatives** would lead to a trend toward Federal listing because viability has been provided by each alternative. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the “Vegetation” section), and the above guidelines and other plan components additionally provide for these species’ needs.

Table 98. Viability effectiveness for dense low-mid canopy with ample ground litter sensitive species

Sensitive FPS Associated with High Water Quality	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Western red bat	+ +	+ +	+	+ +
Coarse filter - ME	+ +	+ +	+ +	+ +
Total effectiveness +'s Coupled with ME	**4**	**4**	**3**	**4**

Unique Habitat Sensitive Species (Permanent Wet Meadow-Like Areas)

Ferris' copper butterfly, nitocris fritillary butterfly, nokomis fritillary butterfly

These sensitive butterfly species have a need for permanent wet meadow areas within forested areas or in WCRAs. These provide nectaring plants and damp sites for minerals. These areas also contain larval host plants: a species of dock or sorrel (genus *Rumex*) for Ferris' copper butterfly and violets (genus *Viola*) for the fritillary butterflies. Drying of these areas from, for instance, stock tank building or soil compaction results in habitat loss. Desired conditions that contribute to the viability of this species as well as fine filter guidelines are listed below:

- All PNVTs Guideline – Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- Riparian Areas Desired Condition – Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.
- Riparian Areas Desired Condition – Active grazing allotments should be managed to maintain or improve to desired riparian conditions (e.g., hydrologic function).
- Wildlife and Rare Plants Guideline – Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives.
- Wildlife and Rare Plants Guideline – Management and activities should not contribute to a trend toward the Federal listing of a species.

Table 99 compares the viability effectiveness of the alternatives. **Alternatives B and D** provide the greatest viability effectiveness as compared to **alternatives A and C**. Individual butterflies may be impacted by any alternative. However, **none of the alternatives** would lead to a trend toward Federal listing because viability has been provided by each alternative. This is because alternative objectives (see table 3) are expected to move habitat toward desired conditions (see the "Vegetation" section), and the above guidelines and other plan components additionally provide for these species' needs.

Table 99. Viability effectiveness for permanent wet meadow-like areas sensitive species

Sensitive FPS Associated with High Water Quality	Alt. A	Alt. B	Alt. C	Alt. D
Fine filter - Ferris' copper butterfly	+ +	+ +	+	+ +
Fine filter - nitocris fritillary butterfly	+ +	+ + +	+ + +	+ + +
Fine filter - nokomis fritillary butterfly	+ +	+ + +	+ + +	+ + +
Coarse filter - ME	+ +	+ + +	+ +	+ + +
Total effectiveness +'s Coupled with ME	8	11	9	11

Highly Interactive Species

Identified highly interactive species are those species that alter habitat in a manner benefitting other species or in the form of affecting prey species, who in turn affect habitat structure and function, or those species that range widely to meet their needs. On the forests, these are pronghorn antelope, Mexican wolf, beaver, Gunnison's prairie dog (although not currently known on the forests), mountain lion, and black bear. All are forest planning species (FPS).

Viability risk ratings for highly interactive species as FPS are included in table 80. The management effect, as a reflection of plan objectives for each alternative, is shown for the habitats associated with highly interactive species in table 78. Sections of the plan that contain plan decisions (components) that benefit these species at the coarse and fine filter are indicated in table 100.

Appendix G contains a crosswalk on how individual species' needs are met by various plan components. The" Wildlife Specialist Report – Viability" (Forest Service, 2014bb) contains more detail on analysis of highly interactive species.

Table 100. Sections of the plan containing plan decisions that address highly interactive species at the coarse and fine filter levels

Viability/Plan Decision	Desired Conditions	Standards	Guidelines
Coarse filter plan decisions that provide viability for: All Highly Interactive Species Pronghorn Antelope Mexican Wolf Beaver Prairie Dog Black Bear Mountain Lion Gunnison's Prairie Dog	Overall Ecosystem Health, Water Resources, All PNVTs, Riparian Areas, Ponderosa Pine, Dry Mixed Conifer, Wet Mixed Conifer Aspen, Madrean Pine-Oak, Grasslands, Piñon-Juniper, Wildlife and Rare Plants, Overall Recreation Opportunities, Wildlife Quiet AreaManagement Area		
Fine filter plan decisions in addition to the coarse filter plan decisions above that provide viability for: Beaver Prairie Dog Black Bear Mountain Lion Gunnison's Prairie Dog			Riparian Areas, All PNVTs , All Forested PNVTs, Ponderosa Pine, Dry Mixed Conifer, Wildlife and Rare Plants

Following are some key plan components (decisions) that help meet the needs of highly interactive species in general and individually:

All Highly Interactive Species

- Desired Condition: Large blocks of habitat are interconnected, allowing for behavioral and predator-prey interactions, and the persistence of metapopulations and highly interactive wildlife species across the landscape. Ecological connectivity extends through all plant communities.
- Desired Condition: Vegetative connectivity provides for species dispersal, genetic exchange, and daily and seasonal movements across multiple spatial scales.
- Guideline: Landscape scale restoration projects should be designed to spread treatments out spatially and/or temporally within the project area to reduce implementation impacts and allow reestablishment of vegetation and soil cover.
- Desired Condition: Recreation use does not negatively affect wildlife habitat and populations. Negative interactions between people and wildlife are minimized.
- Guideline: Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions.
- Desired Condition: WQAs provide semi-primitive nonmotorized recreation opportunities, including relatively quiet recreation opportunities close to or adjacent to intensively used areas (without vehicles less exposure to harm).

Beaver

- Desired Condition: Streamflows provide connectivity among fish populations and provide unobstructed routes critical for fulfilling needs of aquatic, riparian dependent, and many upland species of plants and animals.
- Desired Condition: Ponding and channel characteristics provide habitat, water depth, water duration, and the temperatures necessary for maintaining populations of riparian-dependent species and for their dispersal.
- Guideline: Active grazing allotments should be managed to maintain or improve to desired riparian conditions.

Prairie Dog

- Desired Condition: Average herbaceous vegetation heights vary by grassland PNVT and yearly weather conditions. Ungrazed herbaceous vegetation heights range from 7 to 29 inches in Great Basin grasslands, 7 to 26 inches in montane/subalpine grasslands, and 10 to 32 inches in semi-desert grasslands.
- Desired Condition: Wildlife are free from harassment and from disturbance at a scale that impacts vital functions (e.g., breeding, rearing young) that could affect persistence of the species.

Black Bear

- Desired Condition: Vegetation conditions provide hiding and thermal cover in contiguous blocks for wildlife. Native plant species are present in all age classes and are healthy, reproducing, and persisting.
- Guideline: Hiding cover, approach cover (by waters), and travel corridor cover should be provided where needed by wildlife.
- Desired Condition: Some large patches in the Madrean pine-oak woodland are closed canopy, have multiple age classes, large trees, and old growth-like characteristics (e.g., numerous snags, large coarse woody debris) in order to provide for wildlife such as Mexican spotted owl and black bear that need denser habitat.
- Guideline: Cool and/or dense vegetation cover should be provided for species needing these habitat components (e.g., Goodding’s onion, black bear, White Mountains chipmunk, western yellow-billed cuckoo).

Mountain Lion

- Desired Condition: Herbaceous vegetation amount and structure (e.g., plant density, height, litter, seed heads) provides habitat to support wildlife and prey species.
- Guideline: Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).

Black Bear or Mountain Lion

- Guideline: Where Gambel oak or other native hardwood trees and shrubs are desirable to retain for diversity, treatments should improve vigor and growth of these species. *(provides low cover for hiding or stalking)*
- Desired Condition: Snags and coarse woody debris are well distributed throughout the landscape. The number of snags and logs and amount of coarse woody debris varies by seral state ranging from 8 to more than 16 tons per acre. *(provides low cover for hiding or stalking)*
- Desired Condition: Aspen may compose 10 to 100 percent of the area depending on disturbance (e.g., fire, insects, silvicultural treatments), in multistoried patches. *(provides low cover for hiding or stalking)*

In addition to the above plan components, management areas such as wildlife quiet areas (see the following section) provide for the needs of these species. The viability of highly interactive species is, therefore, well provided for under **all alternatives**.

Other Planning Species

The following 30 forest planning species (FPS) are not discussed in the above groups of species (ESA, sensitive, and highly interactive). Their viability by alternative and as a group is found in table 80 and table 83, respectively.

The management effect, as a reflection of plan objectives for each alternative, is shown for the habitats associated with these other FPS in table 78. Sections of the plan that contain plan decisions (components) that benefit these species at the coarse and fine filter are indicated in table 101. In addition, appendix G contains a crosswalk on how individual species' needs are met by various plan components. The "Wildlife Specialist Report – Viability" (Forest Service, 2014bb) contains more detail on analysis of these other FPS.

Table 101. Sections of the plan containing plan decisions that address other FPS needs at the coarse and fine filter levels

Viability/Plan Decision	Desired Conditions	Standards	Guidelines
Coarse filter plan decisions that provide viability for: Arizona myotis bat mule deer Abert's squirrel red squirrel juniper titmouse evening grosbeak dusky blue grouse flammulated owl savannah sparrow Bigelow's onion wood nymph superb penstemon splachnoid dung moss crenulate moonwort	Overall Ecosystem Health. All PNVTs, Wildlife and Rare Plants		
Fine filter plan decisions in addition to the coarse filter plan decisions above that provide viability for: red-faced warbler Swainson's thrush Montezuma quail Grace's warbler Lincoln's sparrow MacGillivray's warbler plateau giant tiger beetle false ameletus mayfly Mosely caddisfly Alberta arctic butterfly White Mountains water penny beetle Mexican hemlock parsley yellow Jacob's-ladder hooded lady's tresses Oak Creek triteleia carnivorous bladderwort		Aquatic Habitat and Species, Grasslands, Invasive Species, Water Uses, Dispersed Recreation, Motorized Opportunities, Forest Products, Special Uses	Water Resources, Aquatic Habitat and Species, All PNVTs, Riparian Areas, Aspen, Wildlife and Rare Plants, Invasive Species, Motorized Opportunities, Nonmotorized Opportunities, Forest Products, Livestock Grazing, Special Uses, Energy Corridor Management Area, Research Natural Area Management Area, Recommended Research Natural Area Management Area

Other Factors of Viability Concern

Other identified factors of concern for viability of certain FPS are addressed by fine filter standards and guidelines. Table 102 contains some key plan components (decisions) addressing these concerns.

Table 102. Other factors of concern and affected forest planning species (FPS)

Other Factors of Concern	FPS	Addressed by Fine Filter Standard or Guideline
Collection or loss from management	nitocris fritillary butterfly, nokomis fritillary butterfly, yellow lady’s slipper, hooded lady’s tresses	When new water diversions are created or existing water diversions are reanalyzed, measures should be taken to prevent entrapment of fish and aquatic organisms. Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives. Pesticide use should minimize impacts on nontarget plants and animals. Authorizations to cut, collect, or use forest products for any personal, commercial, or scientific purpose (i.e., permits, contracts, agreements) shall include provisions to ensure the needs of wildlife, which depend upon those forest products, will continue to be met (e.g., fungi and cone collection with respect to overwinter forage needs of squirrels). Permits issued for forest products should include stipulations to protect resources. Special use authorizations for the collection of live species with limited distribution (e.g., some invertebrates, plants) shall include permit provisions to ensure the species persist onsite. Research special use authorizations should limit impacts to sensitive resources, unique features, and species. The use of underground utilities should be favored to avoid potential conflicts with resources (e.g., scenic integrity, wildlife, wildfire, heritage). Power pole installation or replacement under special use authorization should include raptor protection devices in open habitat such as large meadows and grasslands. Raptor protection devices should be installed on existing poles where raptors have been killed.
Nest parasitism	southwestern willow flycatcher, Grace’s warbler	Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives. Projects and authorized activities shall be designed to reduce the potential for the introduction of new species or spread of existing invasive or undesirable aquatic or terrestrial nonnative populations.
Disease	Townsend’s big-eared bat, spotted bat, western red bat, Arizona toad, Chiricahua leopard frog, northern leopard frog, lowland leopard frog	To prevent degradation of native species habitat and the incidental or accidental introduction of diseases or nonnative species, aquatic species should not be transferred through management activities from one 6th level HUC watershed to another. When drafting (withdrawing) water from streams or other waterbodies, measures will be taken to prevent entrapment of fish and aquatic organisms and the spread of parasites or disease (e.g., Asian tapeworm, chytrid fungus, whirling disease). To reduce disturbances from human activities and prevent the spread of disease, bat gates should be constructed and installed in cave and mine entrances used as shelter for bats within 3 years of discovery when there are no conflicts with cultural resources. Caves and abandoned mines that are used by bats should be managed to prevent disturbance to species and spread of disease (e.g., white-nose syndrome).
Entrapment	FPS that are small mammals, bats, and young of other	Sufficient water should be left in streams to provide for aquatic species and riparian vegetation. When new water diversions are created or existing water diversions are reanalyzed, measures

Other Factors of Concern	FPS	Addressed by Fine Filter Standard or Guideline
	species	should be taken to prevent entrapment of fish and aquatic organisms. New or reconstructed fencing shall allow for wildlife passage, except where specifically intended to exclude wildlife (e.g., elk fencing). New livestock watering facilities shall be designed to allow wildlife access and escape. During maintenance of existing watering facilities, escape ramps that are ineffective or missing should be replaced.
Substantial predation or competition from invasive species	pronghorn antelope, Three Forks springsnail	Vegetation treatments shall include measures to reduce the potential for introduction of invasive plants and animals and damage from nonnative insects and diseases. To prevent degradation of native species habitat and the incidental or accidental introduction of diseases or nonnative species, aquatic species should not be transferred through management activities from one 6th level HUC watershed to another. Projects and activities should not transfer water between drainages or between unconnected waterbodies within the same drainage to avoid spreading disease and aquatic invasive species. Noxious plants and nonnative invasive species monitoring and control shall be included in contracts, permits, and agreements. Management should focus on operation and maintenance, safety, aesthetics, and control of noxious weeds and nonnative invasive species. Invasive plant species should be aggressively controlled within energy corridors to prevent or minimize spread.
Intentional harassment, forced removal, or avoidable disturbance	Mexican wolf, Gunnison's prairie dog, black bear, many FPS (at least during important life cycle periods)	Cool and/or dense vegetation cover should be provided for species needing these habitat components (for hiding)... Hiding cover, approach cover (by waters), and travel corridor cover should be provided where needed by wildlife. Developed and dispersed recreation sites and other authorized activities should not be located in places that prevent wildlife or livestock access to available water. Recreation use does not negatively affect wildlife habitat and populations. Negative interactions between people and wildlife are minimized. Firelines, helispots, and fire camps should be located to avoid disturbance to critical species and impacts to cultural resources. Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions. Prairie dog controls should not be authorized except when consistent with approved State of Arizona Gunnison's prairie dog conservation strategies. Food and other items that attract wildlife should be managed to prevent reliance on humans and to reduce human-wildlife conflicts. Where trash facilities are provided, they shall be bear resistant. Dispersed campsites should not be located on or adjacent to archaeological sites or sensitive wildlife areas. All WQAs should be managed to preclude snowmobile use to minimize disturbance during the critical winter period. WQA boundaries should be signed to identify the areas and educate the public about their purpose. Large group and recreation event special uses should not be authorized within wilderness, recommended wilderness, primitive area, wildlife quiet areas, eligible "wild" river corridors, riparian and wetland areas, cultural resource sites, Phelps Cabin Botanical Area, Phelps Cabin.

An additional guideline addresses some of these concerns: "Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives." In summary, although some of these factors of concern are not entirely under Forest Service control, the above plan components help provide for viability of these identified FPS species under **all alternatives**.

Management Indicator Species, Migratory Birds, and Eagle Consequences

Management Indicator Species (MIS)

As previously noted, the role of management indicator species (MIS) and the basis for their selection is to estimate the effects of each forest plan alternative on identified species. These species are selected for alternative comparison (and for later monitoring) in order to assess the effects of management on their populations and the populations of other species with similar habitat needs which they may represent. See the "Report on the Selection of Management Indicator Species and Ecological Indicators" (Forest Service, 2012d) for information about the merits of Mexican spotted owl, northern goshawk, and pronghorn antelope as MIS and background on the MIS selection process.

Comparison of the consequences of **alternative A** and the **action alternatives (B, C, and D)** are discussed for the three management indicator species follows. All plan components relevant for MIS species are listed in the "Wildlife Specialist Report – Viability" (Forest Service, 2014bb) In addition, appendix G lists all standards and guidelines that address MIS and other wildlife species needs. Standards and guidelines along with objectives form the basis for the determination of consequences for MIS for each alternative. Table 103 below compares the management effect for the indicator habitats of the three MIS by alternative.

Table 103. Management effect compared by alternative for the MIS indicator habitats

MIS and Habitat	Management Effect[a]			
	Alt. A	Alt. B	Alt. C	Alt. D
Mexican Spotted Owl				
Dry mixed conifer	2	1	1	1
Wet mixed conifer	2	1	1	1
Northern Goshawk				
Ponderosa pine	2	1	1	1
Pronghorn Antelope				
Great Basin grassland	3	1	3	1

Table rating description or other information:

[a] Management effect: 1 = greatest relative improvement in suitable habitat through management and activities; 2 = intermediate relative improvement; 3 = least to no relative improvement.

Mexican Spotted Owl (Dry Mixed Conifer and Wet Mixed Conifer PNVTs)

Alternative A: The Mexican spotted owl (MSO), is identified as a MIS for management area 1 (forested lands) of the 1987 plan. It includes woodlands, ponderosa pine, mixed conifer[31], aspen, and spruce-fir. The management emphasis is for multiple uses including timber production, wildland fire, wildlife habitat, grazing, watershed, and dispersed recreation. Some direction in the 1987 plan for management area 1 includes protection of stands from insect and disease beyond endemic levels; manage for a minimum of 20 percent of the area to provide vertical diversity, a minimum of 30 percent to provide horizontal diversity; allocate no less than 20 percent of each forested ecosystem to old growth that flows across the landscape over time; use pre-European settlement information to develop prescriptions; provide from 1.8 to 2.8 snags per acre; provide a minimum of two logs per acre 12 inches or larger; and manage livestock to protect aspen regeneration treatments. Table 72 notes the acreage of MSO dry mixed conifer and wet mixed conifer indicator habitat and the amount that is currently suitable post-Wallow Fire.

Alternatives B, C, and D: These alternatives all provide desired conditions, standards, or guidelines favorable for the Mexican spotted owl and its indicator habitat (i.e., dry mixed conifer and wet mixed conifer forests). Key examples are found in the ESA section above so are not reiterated here.

Alternatives compared: For the Mexican spotted owl, differences among alternatives relate primarily to differences in treatment objectives and overall management effect. Plan implementation objectives for forested PNVTs are found in table 3. The maximum restoration of forested acreage per year to occur in any of the four forested PNVTs is, by alternative: **alternative A** 17,000 acres; **alternative B** 35,000 acres; **alternative C** 55,000 acres; and **alternative D** 50,000 acres.

The habitat quality or suitability of MSO indicator would vary from existing conditions based on reduced departure from (i.e., movement toward) desired conditions in these indicator PNVTs by alternative. Based on modeling, **alternatives B and D** are intermediate in improvement of habitat quality for these two PNVTs. Dry mixed conifer forests have the greatest habitat improvement under **alternative C**, while wet mixed conifer forests have the greatest habitat improvement under **alternative A**. Because of these mixed outcomes, the overall habitat quality for MSO is considered similar under plan implementation for all alternatives.

As previously noted, there was substantial loss of acreage in MSO breeding and critical habitat from the 2011 Wallow Fire. Total number of breeding MSO pairs is, therefore, likely down after the fire, but population trend is expected to stabilize over the 15-year planning period because forest treatments under **all alternatives** would incorporate “Mexican Spotted Owl Recovery Plan” (USFWS, 1995). direction, including provisions for primary constituent elements of habitat.

Northern Goshawk (Ponderosa Pine PNVT)

Alternative A: The Northern goshawk is identified as an MIS for management area 1 (forested lands), of the 1987 plan. It includes woodlands, ponderosa pine, mixed conifer, aspen, and spruce-fir. The management emphasis includes timber production and wildland fire, wildlife

[31] This includes both dry mixed conifer and wet mixed conifer forests which would be indicator habitat for MSO as a management indicator species under the action alternatives (B, C, and D).

habitat, grazing, watershed, and dispersed recreation. See the previous MSO section for some of the direction in the 1987 plan for management area 1 which encompasses ponderosa pine, the indicator habitat for this MIS. Table 75 notes the acreage of NOGO ponderosa pine indicator habitat and the amount that is currently suitability post-Wallow Fire.

Alternatives B, C, and D: These alternatives all provide desired conditions, standards, or guidelines favorable for the northern goshawk and its habitat. Key examples include the following:

- Desired Condition: Northern goshawk post-fledging family areas (PFAs) may contain 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest.
- Desired Condition: Northern goshawk nest areas have forest conditions that are multi-aged and dominated by large trees with relatively denser canopies than the surrounding forest.
- Guideline: A minimum of six nest areas (known and replacement) should be located per northern goshawk territory. Northern goshawk nest and replacement nest areas should be located around active nests, in drainages, at the base of slopes, and on northerly (NW to NE) aspects. Nest areas should be 25 to 30 acres each in size.
- Guideline: Northern goshawk post-fledging family areas (PFAs) of approximately 420 acres in size should be designated around the nest sites.
- Guideline: Active raptor nests should be protected from treatments and disturbance during the nesting season to provide for successful reproduction. Specifically for northern goshawk nest areas, human presence should be minimized during nesting season of March 1 through September 30.
- Desired Condition: Diverse vegetation structure, species composition, densities, and seral states provide quality habitat for native and desirable nonnative plant and animal species throughout their life cycle and at multiple spatial scales. Landscapes provide for the full range of ecosystem diversity at multiple scales, including habitats for those species associated with late seral states and old growth forests.
- Desired Condition: Herbaceous vegetation amount and structure (e.g., plant density, height, litter, seed heads) provides habitat to support wildlife and prey species.
- Desired Condition: Livestock grazing and associated activities contribute to healthy, diverse plant communities, satisfactory condition soils, and wildlife habitat.
- Guideline: Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- Guideline: Trees, snags, and logs immediately adjacent to active red squirrel cone caches, Abert's squirrel nests, and raptor nests should be retained to maintain needed habitat components and provide tree groupings.
- Desired Condition: Wildlife are free from harassment and from disturbance at a scale that impacts vital functions (e.g., breeding, rearing young) that could affect persistence of the species.
- Desired Condition: Recreation use does not negatively affect wildlife habitat and populations. Negative interactions between people and wildlife are minimized.

- Guideline: Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions.
- Guideline: The use of underground utilities should be favored to avoid potential conflicts with resources (e.g., scenic integrity, wildlife, wildfire, heritage).
- Desired Condition: WQAs provide semi-primitive nonmotorized recreation opportunities, including relatively quiet recreation opportunities close to or adjacent to intensively used areas.

Alternatives compared: For the northern goshawk, differences among alternatives relate primarily to differences in treatment objectives and overall management effect. Plan implementation objectives for forested PNVTs are found in table 3. As noted above, the maximum restoration of forested acreage per year to occur in any of the four forested PNVTs is, by alternative: **alternative A** 17,000 acres; **alternative B** 35,000 acres; **alternative C** 55,000 acres; and **alternative D** 50,000 acres. **All alternatives** emphasize treatment in the ponderosa pine which is currently more departed from reference conditions than the other forested PNVTs.

The habitat quality or suitability of NOGO indicator habitat would vary from existing conditions based on reduced departure from (i.e., movement toward) desired conditions in this indicator PNVT by alternative. Based on modeling, alternatives that provide the greatest to the least habitat improvement are **alternatives C and B**, followed by **alternative D**, then **alternative A**.

Based on habitat quality improvement (see the alternative objectives above), an upward population trend for northern goshawk would be expected under **all alternatives**, especially for **alternatives C and B**, followed by **alternative D,** then **alternative A**.

Pronghorn Antelope (Great Basin Grassland PNVT)

Alternative A: Pronghorn antelope, or pronghorn, are identified as a MIS for management area 4 (grasslands) of the 1987 plan. The management emphasis for the area is visual quality and wildlife habitat, especially big game winter habitat. Some of the direction in the 1987 plan includes fencing to keep livestock from wetter areas, piping water from wet areas to less sensitive areas, livestock control to allow grass and forb regeneration (both cool and warm season growing plants), and leaving new land acquisitions in critical big game range generally unstocked.

Direction in the 1987 plan includes re-treating approximately 50,000 acres within previous overstory removals over a 25-year period. Actual tree removal in the Great Basin grassland occurring over the last decade or so averages roughly 500 acres per year.

Alternatives B, C, and D: These alternatives all provide desired conditions, standards, or guidelines favorable for the pronghorn antelope and its habitat. Key examples include the following:

- Desired Condition: Large blocks of habitat are interconnected, allowing for behavioral and predator-prey interactions, and the persistence of metapopulations and highly interactive wildlife species across the landscape. Ecological connectivity extends through all plant communities.
- Desired Condition: Habitat configuration and availability allows wildlife populations to adjust their movements (e.g., seasonal migration, foraging) in response to climate change and promote genetic flow between wildlife populations.

- Desired Condition: Vegetative ground cover (herbaceous vegetation and litter) is optimized to protect and enrich soils and promote water infiltration. There is a diverse mix of cool and warm season grass and desirable forb species.
- Desired Condition: Native plant communities dominate the landscape.
- Desired Condition: During the critical antelope pronghorn fawning period (May through June), cool season grasses and forbs provide nutritional forage, while shrubs and standing grass growth from the previous year provide adequate hiding cover (10 to 18 inches) to protect fawns from predation.
- Guideline: New fence construction or reconstruction where pronghorn antelope may be present should have a barbless bottom wire which is 18 inches from the ground to facilitate movement between pastures and other fenced areas. Pole and other types of fences should also provide for pronghorn antelope passage where they are present.
- Desired Condition: Livestock grazing and associated activities contribute to healthy, diverse plant communities, satisfactory condition soils, and wildlife habitat.
- Desired Condition: Livestock grazing is in balance with available forage (i.e., grazing and browsing by authorized livestock, wild horses, and wildlife do not exceed established use levels).
- Guideline: Pronghorn antelope fence and other crossings should be installed along known movement corridors to prevent habitat fragmentation.
- Desired Condition: Woolhouse WQA on the Lakeside Ranger District provides high quality winter range for pronghorn antelope and elk within a busy and heavily used wildland-urban interface.
- Desired Condition: These areas (Natural Landscape Management Area) contribute to ecosystem and species diversity and sustainability; serve as habitat for plants and animals; and offer wildlife corridors, reference areas, primitive and semi-primitive nonmotorized recreation opportunities, and places for people seeking natural scenery and solitude. Grasses, forbs, shrubs, and litter are abundant and continuous to support natural fire regimes.

Alternatives compared: For the pronghorn, differences among alternatives relate primarily to differences in treatment objectives and overall management effect. Plan implementation objectives for grasslands are found in table 3. **Alternative A** would continue to restore about 500 acres of Great Basin grassland a year as would **alternative C** except that it has an emphasis for restoring montane/subalpine grassland. **Alternative B** would restore up to 25,000 acres per year with an emphasis in the Great Basin grassland and semi-desert grassland. **Alternative D** would restore up to 24,000 acres per year across all grassland PNVTs.

The quality or suitability pronghorn indicator habitat would vary greatly from existing condition based on the amount of grassland restoration under each alternative and the resulting reduced departure from (i.e., movement toward) desired conditions in this indicator PNVT. Based on modeling, **alternatives B and D** would substantially improve habitat quality, while a slight improvement in habitat quality would be expected under **alternatives A and C**.

Based on habitat quality improvement (see the alternative objectives above), a substantial upward population trend for pronghorn would be expected under **alternatives B and D** and a slight upward population trend would be expected under **alternatives A and C**.

Migratory Birds and Important Bird Areas

Sections of the plan that contain plan decisions (components) that address habitat and management that benefit migratory birds are indicated in table 104 below. Appendix G contains a crosswalk on how individual species' needs are met by various plan components. The "Wildlife Specialist Report – Migratory Birds, Eagles, and Important Bird Areas" (Forest Service, 2014y) contains more detail on analysis of migratory birds.

Table 104. Sections of the plan containing plan decisions that address migratory birds

Desired Conditions	Standards	Guidelines
All PNVTs Riparian Areas All Forested PNVTs Piñon-Juniper	None	Ponderosa Pine Dry Mixed Conifer All Woodland PNVTs

Alternatives compared: Migratory birds are not specifically addressed in the 1987 plan (**alternative A**). However, **all alternatives** help restore and enhance migratory bird habitat. Plan decisions benefit migratory birds through the following:

- Desired riparian conditions include vegetation that is structurally diverse and provide for high bird species densities, especially neotropical migratory birds.
- Each forested type has desired conditions for needed number of snags.
- Vegetation states with denser canopies are included in desired conditions for forested PNVTs.
- Retention of Gambel oak is addressed in a guideline.
- Retention of groups of medium to large and old trees in the piñon-juniper woodlands is addressed in a guideline.
- Grassland desired conditions specify herbaceous and shrub ground cover ranges from 7 to 32 inches in height depending on PNVT.

The forests would continue to fulfill obligations under the 2008 MOU between the Forest Service and USFWS regarding conservation of migratory birds, regardless of alternative. The "Wildlife Specialist Report – Migratory Birds, Eagles, and Important Bird Areas" (Forest Service, 2014y) provides the environmental analysis of agency actions on migratory birds and the plan includes guidelines to minimize effects (e.g., "Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objective"). The plan's management approach for wildlife for all alternatives is to encourage and support species research and inventory. The forests would also support programs like the National Audubon Society's IBA and provide wildlife education for the public at events like county fairs. These plan components and management approaches contribute to the needs of migratory and other birds regardless of alternative; therefore, **all alternatives** would contribute to bird conservation.

Bald and Golden Eagles

Direction under the 1987 plan (**alternative A**) includes identification and protection of winter bald eagle roosts; no development, including roads, in bald eagle winter roost areas; protection of bald eagle winter roosts with a 300-foot uncut buffer zone; and priority management of old growth stands adjacent to lakes and streams in potential bald eagle wintering sites. Golden eagles are not addressed except as under protection of raptor nest areas.

The 1940 Bald and Golden Eagle Protection Act (Eagle Protection Act), as amended, prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” eagles, and provides criminal penalties for violation. Take includes disturbance caused by human-induced alterations around a nest site, whether eagles are present at the time or not. This could result in decreased eaglet productivity or nest abandonment as a consequence of management or activities. Under the provisions of the 2009 amendment to the Eagle Protection Act (Federal Register (Vol. 72, No. 107, 31133)), a permit for limited, non-purposeful take of bald eagles and golden eagles may be issued to allow government agencies to disturb or otherwise take eagles in the course of conducting lawful activities.

Sections of the plan that contain plan decisions (components) that address habitat and management that benefit bald and golden eagles are indicated in table 105 below. Appendix G contains a crosswalk on how individual species’ needs are met by various plan components. The Wildlife Specialist Report – Migratory Birds, Eagles, and Important Bird Areas (Forest Service, 2014y) contains more detail on analysis of migratory birds.

Table 105. Sections of the plan containing plan decisions that address bald and golden eagles

Desired Conditions	Standards	Guidelines
All PNVTs Riparian Areas All Forested PNVTs Piñon-Juniper	None	Ponderosa Pine Dry Mixed Conifer All Woodland PNVTs

Alternatives compared: The programmatic direction in the land management plan would not constitute “take” of eagles and it would provide for viability of all species, including bald and golden eagles. As such, **all alternatives** would be consistent with the Eagle Protection Act. However, site-specific implementation of plan objectives, such as construction or maintenance of recreation developments, could possibly impact eagles. This would be addressed on a site-specific basis with appropriate permitting from the USFWS, if necessary, regardless of plan alternative.

Other Consequences

Wildlife Quiet Areas (WQAs) and Habitat Security

Wildlife quiet areas (WQAs) would compose a forest management area under **all alternatives** except **alternative A**. Each of the plan alternatives provide for a different set and acreage of WQAs across the forests. In providing for greater habitat security due to less human disturbance, especially motorized use, WQAs help contribute to species viability.

Examination of the layout and scale of the existing WQAs across the forests’ landscape shows they are few and greatly spaced, especially on the Sitgreaves side of the forests. In order to address this, **alternatives B and D** would propose additional WQAs as shown in table 106.

Table 106. Proposed additional wildlife quiet areas by alternative

Additional WQAs	Alt. A (acres)	Alt. B (acres)	Alt. C (acres)	Alt. D (acres)
Bear Springs	—	2,831	—	2,831
Cottonwood Seep	—	2,968	—	2,968
Carr Lake	—	--	—	2,196
Palomino	—	--	—	8,028
Hidden Lake	—	--	—	3,227
Total acres of additional WQAs	0	5,799	0	19,250

To facilitate alternative comparison, it is assumed that the eight existing WQAs would remain in place under **alternative A** through special closure order. These WQAs would become a plan management area (Wildlife Quite Area Management Area) under the **action alternatives**. The sizes (acreage) of WQAs including the ones additionally proposed are summarized by number and acreage in table 107 by alternative.

Table 107. Number of occurrences and acres of WQA management areas that provide greater habitat security by alternative

Alternative	Number of Occurrences[a]	Acres (Percent)
A	8	45,506 (2%)
B	10	50,173 (3%)
C	8	44,373 (2%)
D	12	59,379 (3%)

[a] Number of occurrences represents the number of individual areas assigned to the management area or, for alternative A, designated by special closure order.

In addition to WQAs, other management areas such as wildernesses, recommended wilderness, primitive area, research natural areas, recommended research natural areas, and natural landscapes also provide greater habitat security. The location of existing and proposed WQAs by alternative, along with other management areas providing greater habitat security, is shown in figure 51. For more details about secure habitat areas, including acreages, see the “Wildlife Specialist Report – Viability” (Forest Service, 2014bb).

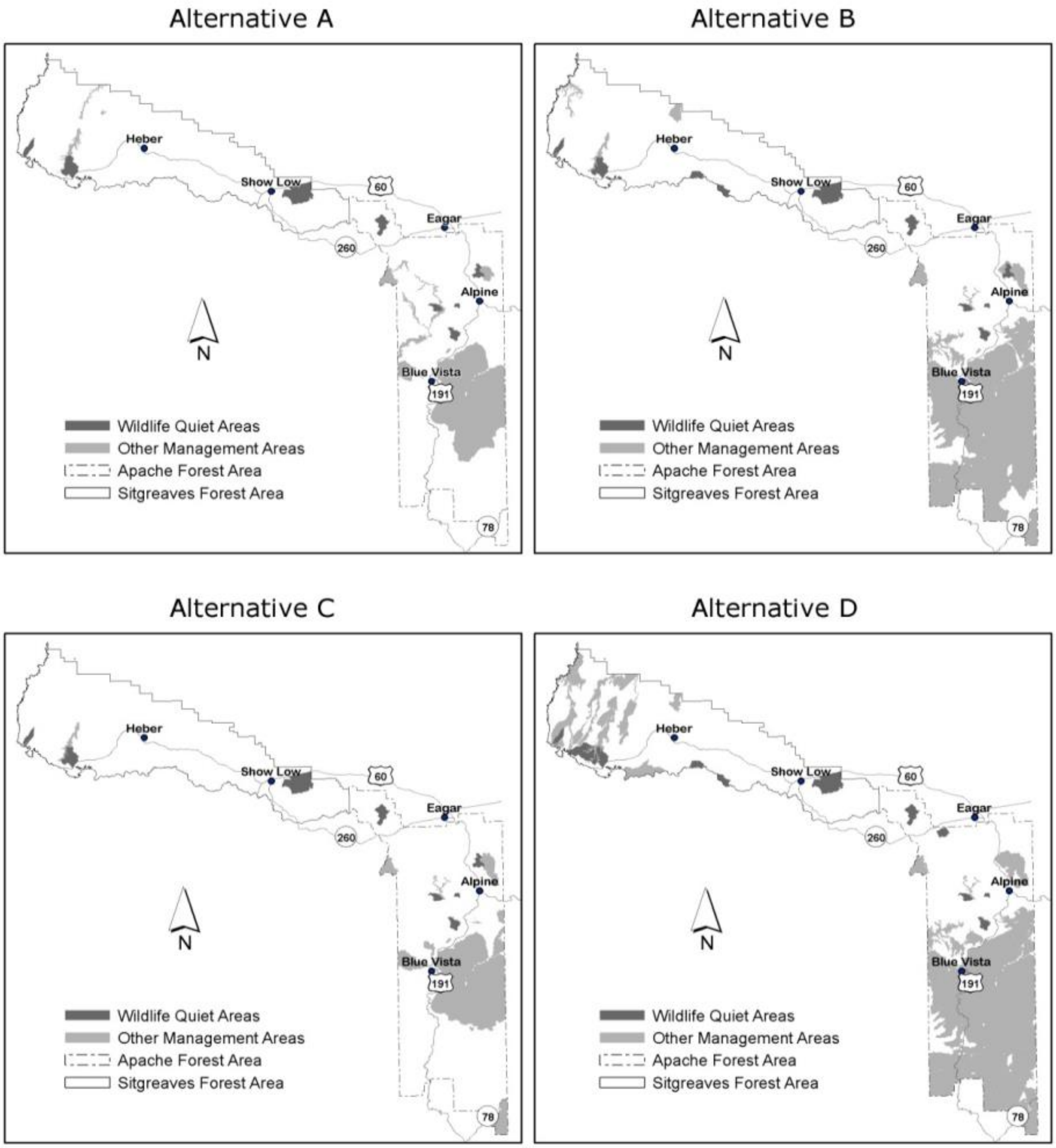

Figure 51. Maps of wildlife quiet areas (WQAs) and other management areas (MAs) providing more secure habitat for each alternative

Alternatives compared: WQAs and other secure habitat areas would provide beneficial environmental consequences of longevity and continuity of wildlife use. These areas would lend themselves to assessing the impact of broad-scale thinning and wildland fire treatments and the evaluation of species viability across the forests. They also respond to public input to provide for wildlife and habitats in a sustainable manner. **Alternative D** would provide the greatest amount of acreage in secure habitats, followed by **alternative B**, then **alternatives A and C**.

Habitat Connectivity and Linkages

The premise for WQAs and other more secure habitat management areas is that, in general, the closer secure habitat areas are to one another, the less species risk and more viability effectiveness there is. Safe linkages across the landscape are provided by a number of standard and guidelines that address physical obstacles to habitat connectivity. In addition, straight line distances between these areas are estimated as a relative indicator of habitat connectivity in order to compare the alternatives. table 108 displays the estimated average distance between more secure management areas for wildlife by alternative.

Table 108. Habitat connectivity indicator, estimated average distance in miles between management areas by alternative for relative comparisons of alternatives

	Alternative A[a]	Alternative B	Alternative C[a]	Alternative D
Management areas that provide habitat security (includes WQAs)	**Sitgreaves side of the Apache-Sitgreaves NFs**			
	24.1 miles	12.2 miles	24.3 miles	15.3 miles
	Apache side of the Apache-Sitgreaves NFs			
	6.8 miles	5.5 miles	5.9 miles	4.3 miles
	Across the Apache-Sitgreaves NFs			
	10.1 miles	7.6 miles	9.1 miles	6.1 miles

[a] While both alternatives A and C have the same number of WQAs, there are differences among management areas and their acreages.

Alternatives compared: Standards and guidelines related to habitat connectivity and safe linkages are in all alternatives; hence **all alternatives** would provide the same viability effectiveness relative to fine filters. These include guidelines for fences and wildlife crossings, and placement of trails relative to wildlife movement. Some management areas have fewer short-term implementation impacts (e.g., use of wildland fire in wilderness) that also contributes to viability effectiveness.

Based on the estimated average distances across the Apache-Sitgreaves NFs between secure management areas from table 108, **alternative D** would have less viability risk and, therefore, the most viability effectiveness in terms of habitat connectedness and linkages. It is followed by **alternative B**. **Alternatives A and C** are similar and, compared to **alternatives B and D**, they have greater risk and less viability effectiveness. Should WQAs not be retained under **alternative A** by special closure order, this alternative would have even less habitat effectiveness.

Climate Change

Average global temperature increases in the 20th century occurred at a rate greater than during the previous nine centuries (IPCC, 2007a; Karl, et al., 2009). Species composition shifts have been detected in studies in southeastern Arizona (Brown et al., 1997). Evidence of impacts from changing climate has been demonstrated on a study site near the boundary of the Apache-Sitgreaves NFs and Coconino NF near the Mogollon Rim. During a long-term study, Martin and Maron (2012) found that the abundance of deciduous trees and associated songbirds have declined with decreasing snowfall and associated impacts over 22 years.

Part of the approach to address changes that can impact terrestrial and aquatic ecosystems and better help native species to persist include reducing biotic and abiotic stressors (Beschta et al., 2012). Modifying or resetting vegetation structure toward reference (desired) conditions would help make Apache-Sitgreaves NFs vegetation types more resistant, resilient, functional, and better able to absorb disturbance and reestablish ecosystem functions while undergoing change. A resilient ecosystem can better withstand stress like drought, or can rebuild after a major disturbance like a serious storm or wildfire, without leading to a major shift in the type of ecosystem or the services it provides. The other part of the approach includes prescriptions for management use within the capability and suitability of the planning unit at a level that allows restoration to progress. **All alternatives** address capability and suitability in compliance with the 1982 Planning Rule.

Overall, **alternatives B and D** would provide for the greatest movement toward desired conditions; therefore, forest resources would be most able to handle climate changes within the planning period. Conversely, **alternatives A and C** would have the least movement toward desired conditions, so forest resources would be comparatively less able to handle climate changes. Based on the assumption that the closer habitats are to desired conditions, the less the risk to species viability, wildlife habitat, and associated species would best be able to adjust to climate changes under **alternatives B and D**. They would be comparatively less able to adjust to climate changes under **alternatives A and C**.

Cumulative Effects

The analysis area for cumulative effects cannot be precisely defined; however, the cumulative effect action area is defined as the extent that wildlife use habitat on the forests and on adjacent lands. An example would be pronghorn where the forests provide primarily summer habitat while adjacent State and private lands provide primarily winter habitat. Although the timing and level of impacts from these other actions cannot be quantified, examples of possible cumulative impacts by types of actions follow.

Thinning and wildland fire activities on adjacent national forest lands (Gila, Coconino, and Tonto NFs) or tribal lands should reduce risks on off-forest landscape which could benefit species whose range extends beyond the forests. Depending on proximity of Apache-Sitgreaves NFs and other activities, the short-term effects of these activities may limit refuge areas for wildlife as escape from project activities or from short-term loss of habitat components. It may also increase the level and extent of disturbance such that breeding or young rearing may be less successful during the years of implementation.

Because developments like wind and solar power facilities, groundwater pumping, mining expansion, and urban development off-forests reduce habitat suitability, habitats on the Apache-

Sitgreaves NFs become that much more important. These developments also result in direct mortality of individual animals. Loss of habitat and animals could result in the decline or loss of certain species if the impacted off-forest habitat cannot be compensated on the forests. Highway improvements, unless they incorporate adequate wildlife corridors and linkages, could result in the decline of certain species, including loss of genetic diversity. In addition, soil and forage loss on some adjacent non-Forest Service lands has already resulted in declines of species, such as pronghorn, which also use habitats on the forests.

Forest land exchange and AZGFD acquisitions for important wildlife lands, conservation agreements, and/or water rights could cumulatively provide more wildlife habitat and protect key habitat areas that are currently in non-Forest Service ownership. Treatment of invasive species on other lands should help reduce risk to species on the forests. Public education and law enforcement conducted by the AZGFD should help protect species and limit disturbance or unlawful removal, cumulatively benefitting species. Reductions in the amount of feral animal populations, conducted by State agencies, should cumulatively improve habitat conditions for wildlife on the Apache-Sitgreaves NFs.

Invasive Species

Invasive plant and animal species are a growing threat to native species, ecosystem function, and the quantity of forest goods and services. This section describes these threats and evaluates the environmental consequences of actions (e.g., road building, mechanical and wildland fire treatments, livestock grazing, recreation) that can contribute to the infestation and spread of invasive species using invasive plant species, brown-headed cowbird, and chytrid as indicators.

The full analysis for invasive species can be found in the “Invasive Species Specialist Report” (Forest Service, 2014k) available in the “Plan Set of Documents,” including a list of the noxious and invasive weeds of the Apache-Sitgreaves NFs and invasive plants of the Southwestern Region.

According to Fairweather et al. (2006), most forest insects and pathogens in the Southwest are naturally occurring components of ecosystems and play an important role in dynamic processes. However, two invasive pest species have become established on the forests: white pine blister rust and spruce aphid. For more information on these species, see the “Forest Health” section.

In the analysis for this resource, the following information was taken into consideration:

- The 2008 “Environmental Assessment for the Apache-Sitgreaves National Forests Integrated Forest-Wide Noxious or Invasive Weed Management Program” (Forest Service, 2008d) analyzed and approved the use of manual, biological, and chemical control agents (herbicides) for the treatment of noxious or invasive species.
- The “Highway Right-of-Way Mitigation for All Threatened, Endangered, and Sensitive Species that Occur on the Apache-Sitgreaves National Forests for ADOT’s Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest Systems Lands in Arizona” (Forest Service, 2005) is implemented and provides protections for federally listed species.

Affected Environment

Executive Order 13112 defines an invasive species as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." The Forest Service relies on Executive Order 13112 to provide the basis for labeling certain organisms as invasive. Based on this definition, the labeling of a species as "invasive" requires closely examining both the origin and effects of the species. The key is that the species must (1) cause, or be likely to cause, harm and (2) be exotic to the ecosystem it has infested before it can be considered for the "invasive" label. Thus, native pests are not considered "invasive," even though they may cause harm. Invasive species infest both aquatic and terrestrial areas and can be identified within any of the following four taxonomic categories: Plants, Vertebrates, Invertebrates, and Pathogens. Additional information on this definition can be found in Executive Order 13112 (Forest Service Manual 2900).

Nonnative plants and animals that do, or have the potential to, cause ecological or economic harm are also classified as invasive species. Invasive species can be terrestrial or aquatic. On the Apache-Sitgreaves NFs, numerous invasive species pose risks to native species and ecosystem function and to the production of forest goods and services.

Management of invasive species is needed across all vegetation types on the Apache-Sitgreaves NFs. There is an array of tools (e.g., chemical, biological, mechanical, cultural) to help managers control or eradicate these species.

Although there is current management emphasis to manage invasive species, the 1987 plan does not provide direction related to the issue of invasive species. To address terrestrial invasive plants, managers have implemented an integrated forestwide noxious or invasive weed management program. Even though complete eradication of invasive species is not always possible, aggressive treatment of existing populations and prevention of new infestations or populations is important to protect native ecosystem diversity.

Invasive Plants

Invasive plants, of which there are nearly 50 species (White, 2008 and 2011), are currently found on at least 30,000 acres of the forests. For example, musk thistle and Siberian elm have spread along roadways; bull thistle and oxeye daisy have become established in numerous meadows and wetlands; cheatgrass and red brome are well established in grasslands and woodlands; and salt cedar has become common along many streams.

Invasive plants are species that grow and spread rapidly, replacing desired plants. Invasive plants generally pose one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host for serious insects or disease, and are new to or uncommon to the U.S. or parts thereof.

Invasive Animals

The most vulnerable species are those tied to aquatic systems, including riparian habitats. Nonnative fish species, along with the American bullfrog and crayfish, impact all native fish, amphibian, reptile, macroinvertebrate, and plant species in those systems. American bullfrog and crayfish have contributed to the listing of seven native fish species and the Chiricahua leopard frog (Marshall et al., 2006; Robinson et al., 2006). They also contributed to the recent classification of the Mexican gartersnake as a candidate for listing under the Endangered Species Act, and are largely responsible for the decline in narrow-headed gartersnake populations. An additional threat to the Chiricahua leopard frog is an introduced fungal skin disease, chytridiomycosis (chytrid) fungus, which is killing frogs and toads worldwide.

Two avian species, brown-headed cowbirds and European starlings, are considered to be invasive and cause problems for several bird species. Competition for nest sites, nest parasitism, brood parasitism, and predation are problems associated with these two bird species (Forest Service, 2008e). Linz et al. (2007) suggest that European starlings may spread infectious diseases that sicken humans and livestock, costing nearly $800 million in health treatment costs and conclude that European starlings conceivably have contributed to the decline of native cavity-nesting birds by taking their nesting sites.

Feral horses have become established in several locations within the forests. Herds (small groups) of these animals can be found along the western forest boundary on the Apache portion (within the Black River drainage on Alpine and Springerville Ranger Districts, areas west of Big Lake on the Springerville Ranger District, and upper Eagle Creek on the Clifton Ranger District) and along the southern forest boundary on the Sitgreaves portion (along and north of Forest Road 300 on the Black Mesa and Lakeside Ranger Districts). A feral horse is defined as a free-roaming horse having escaped from domestication. Feral horses are escaped domestic horses, or their descendants (branded or unbranded), that strayed, escaped, or were deliberately released onto National Forest System lands and continue to survive and reproduce on the forests in the wild. Feral horses are animals that do not meet the definition of a wild free-roaming horse and are considered unauthorized livestock**.** These unauthorized animals are negatively impacting ecological conditions as well as management opportunities were they occur. Feral horses have few natural predators.

Environmental Consequences of Alternatives

Under **all alternatives,** there would a risk of infestation and spread of invasive plants and animals. Invasive plants compete with crops; poison or injure livestock, wildlife, and people; reduce forage for wildlife and livestock; change natural fire regimes; and reduce recreation enjoyment because of thorns and allergies. They also have a significant environmental advantage over native plant species because they are free of natural enemies. Invasive plants pose an increasing threat to native ecosystems. Prevention and direct control methods are needed to stress or remove invasive plants from native plant communities. Invasive infestation may have impacts on forest long-term productivity.

Invasive animals can alter native habitats and contribute to the extinction of native species through predation, introduction of pathogens, or competition for resources (e.g., food, habitat). Alteration of habitat by animals can facilitate the invasion of other nonnative species.

The 1987 plan (**alternative A**) did not address invasive species, although law, regulations, and policy guide current management to contain, control, and eradicate invasive species. The **action alternatives**, however, contain direction to contain, control, or eradicate invasive species. These alternatives also would provide objectives to treat 500 to 3,500 acres and at least 2 stream miles annually. The **action alternatives**, based on a more aggressive strategy for treating invasive species, would reduce the risk of infestation and spread more than **alternative A**.

Motorized Routes

Roads can serve as a key indicator for the risk of invasive plant species spread. Vehicles driven through populations of invasive plants often pick up seeds or other plant parts and transport these items to previously uninfected areas (Trunkle and Fay, 1991). Chytrid fungus which survives in wet or muddy environments could be carried inadvertently in mud clinging to vehicles and transported to previously uninfested areas. According to Petit (no date), almost everything humans do in manipulating the environment is beneficial to brown-headed cowbirds. Removing or cutting into the forest for roads or timber harvesting, for example, can improve the habitat for brown-headed cowbirds by creating grassy foraging areas, open perch sites for surveying hosts, and more access to host species in edge or open forest habitats. Table 116 (see the "Infrastructure" section) displays the amount of the forests that are suitable for future consideration of new roads. It is based on management area direction.

The acres available for consideration of new motorized areas, NFS roads, NFS motorized trails, and temporary roads range from 1,095,135 to 1,696,497 acres. This level of suitable acres indicates the risk of new road and trail development, thus the potential additive risk of invasive plant species, chytrid fungus, and brown-headed cowbird spread. **Alternative C** would produce the most risk, followed by **alternatives A, B**, **and D.**

Mechanical and Wildland Fire Treatments

Table 109 lists the average annual acres of mechanical treatments by alternative. The associated ground disturbance increases the potential risk for invasive plant species, chytrid fungus, and brown-headed cowbird spread. **Alternative C** would produce the greatest risk, followed by **alternatives B, D, and A** with the least risk.

Areas where ground-disturbing activities take place can serve as an indicator for the risk of invasive plant species and chytrid fungus spread and establishment. Logging equipment driven through populations of invasive plants can pick up seeds and/or chytrid fungus infected mud and transport them to previously uninfested areas (Trunkle and Fay, 1991). Areas of disturbed and exposed soil are ideal locations for the establishment of invasive plants. Logging debris and slash disposal also produces disturbed sites with little or no native ground cover that could provide locations for the establishment of new infestations of invasive plants. Roadside water collection locations are also ideal locations for the establishment of chytrid. Mechanical treatments could improve the habitat for brown-headed cowbirds by creating grassy foraging areas, open perch sites for surveying hosts, and more access to host species in edge or open forest habitats.

Table 109. Average annual acres of mechanical and wildland fire treatments by alternative

Treatment	Alt. A Acres	Alt. B Acres	Alt. C Acres	Alt. D Acres
Mechanical	12,182	19,591	23,997	15,954
Wildland Fire	6,844	28,930	12,857	48,927

Table 109 also indicates the risk of exposing soil through wildland fire activities, thus the potential additive risk of invasive plant species establishment and spread. **Alternative D** would produce the greatest risk, followed by **alternatives B, C**, **and A** with the least risk.

Areas where wildland fire activities take place can also serve as an indicator for the risk of invasive plant species establishment and spread. Areas of disturbed and exposed soil produced by fire are ideal locations for the establishment of invasive plants.

In addition, **all alternatives** would have potential effects from treatments used to mitigate damage caused by uncharacteristic wildfire. Burned areas may require some form of treatment to minimize flooding and soil loss. Primarily these treatments consist of mulching (covering the ground with some form of straw) and seeding. Both the introduction of straw and seed pose risk for the spread and establishment of invasive weeds. **All alternatives** would require the use of certified weed-free straw and seeds and, as a result, present the same potential level of risk.

Livestock Grazing

All alternatives would provide for the continuation of livestock grazing on the forests and focus on balancing livestock grazing with available forage. As a result, **all alternatives** would present the same potential level of risk for chytrid, brown-headed cowbird, and invasive plant spread.

Livestock grazing takes place on 92 grazing allotments covering approximately 1.7 million acres. According to the U.S. Fish and Wildlife Service (USFWS, 2003), chytrid could conceivably be spread by cattle carrying mud on their hooves and moving among Chiricahua leopard frog habitat. The disease could also be spread by ranch hands working at an infected tank or aquatic site and spreading the fungus to another site by mud or water clinging to wheel-wells, tires, shovels, boots, or other equipment.

Livestock enhance feeding opportunities for brown-headed cowbirds by reducing grass height and increasing food availability in the form of invertebrates, body parasites, insects, and seeds (Goguen and Mathews, 2001). Widespread livestock grazing, agriculture, irrigation, and human development have probably all facilitated the range expansion of brown-headed cowbirds (Rothstein, 1994). There is no data that indicates the trend in brown-headed cowbird population levels on the forests. However, current levels of brown-headed cowbirds are negatively affecting the endangered southwestern willow flycatchers, and effects may not be limited to parasitism per se and may be more severe than indicated by parasitism rates alone (Arcese and Smith, 1999; Woodward and Stoleson, 2002).

Grazing contributes to the risk of invasive plant infestation and spread. Grazing and trampling cause (1) the removal of native plants, clearing vegetation, (2) destruction of soil crust and preparation of weed seedbeds through hoof action by establishing openings and uncovering soil, and (3) the transport and dispersal of seeds from one area to another (Parks et al., 2005). All of these actions favor the establishment and spread of invasive plants; current levels of infestations are not expected to be reduced by livestock grazing.

Recreation

Aquatic-based recreation has the potential to spread chytrid in much the same way as other vehicular use, as well as fishing, boating, walking, and playing in streams and ponds. **All alternatives** would provide for the continuation of recreation on the forests and, as a result, present the same potential level of risk for chytrid spread.

Alternative A would allow motorized cross-country travel throughout the forests and there would be greater potential for plant species and chytrid fungus to spread because of vehicular use and the potential for ground disturbance. The **action alternatives** would restrict motorized vehicle travel to only designated roads, trails, and areas and would limit opportunities to spread invasive species.

Climate Change

There may be environmental consequences as a result of climate change. The forests may be more vulnerable to invasive species, including insects, plants, fungi, and vertebrates. Ecosystem change may arise from large scale high severity wildfires that lead to colonization of invasive species (Joyce et al., 2006). Disturbance may reset and rejuvenate some ecosystems in some cases, and cause enduring change in others. For example, climate change may favor the spread of invasive, nonnative grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas burn, they typically convert to nonnative monocultures and the native vegetation is lost (Ryan et al., 2008). The need to treat invasive species may likely become more critical to maintaining desired conditions for healthy plant and animal communities under a changing climate. The state of knowledge needed to address climate change at the forest scale is still evolving. **All alternatives** would direct managers to contain, control, and eradicate invasive species and would use adaptive management to adjust to changing conditions.

Cumulative Environmental Consequences

Since there is expected to be continued growth in urban areas in and around the Apache-Sitgreaves NFs, it is reasonably foreseeable that the growth and expansion of invasive species on surrounding lands would continue and could threaten to extend onto NFS lands. Management under **all alternatives** focuses on containment, control, and eradication of invasive species. These efforts, in combination with similar efforts of other agencies and landowner groups (AZGFD, ADOT, and the cooperative weed management area), would have a positive effect toward controlling infestation and spread from and onto surrounding lands.

Recreation

This section describes the existing recreation opportunities on the forests and recreation user trends. It examines (1) the changes in recreation opportunities by alternative using Recreation Opportunity Spectrum (ROS) mapping, (2) changes in the amount of land suitable for future consideration of motorized and nonmotorized recreation by alternative, and (3) the environmental consequences of allowing or not allowing motorized cross-country travel. ROS descriptions can be found in the “Glossary.” Methodology can be found in the “Recreation Specialist Report” (Forest Service, 2014o) in the “Plan Set of Documents.”

In the analysis for this resource, assumptions include the following:

- Recreation demand on the Apache-Sitgreaves NFs is tied to population changes in the major metropolitan areas of Arizona since approximately 70 percent of the forests’ Arizona visitors are from the Phoenix and Tucson metropolitan areas (Kocis et al., 2002).
- It is anticipated and assumed that recreation use across all alternatives would continue to increase at rates similar to those documented across the Nation. As such, the capacity for recreation resources would ultimately be limited by the quality of the recreation opportunity. Since demands and use are expected to increase, additional analysis may be warranted at some point in the future.

- The recreation use data in this report is from the 2001 National Visitor Use Monitoring (NVUM) survey. An additional survey was conducted in 2007, but the survey sample size was deemed too small to be statistically accurate.
- Visitors to the forests have different preferences for their recreation setting and the activities in which they want to participate. These differences and preferences range from highly intensive uses that have lasting effects on resources to benign uses barely discernible on the ground. Recognizing the differences in user preferences, the primary goal of managing outdoor recreation is to provide an environment or opportunity in which visitors can have a satisfying experience, while protecting the natural and cultural resources integral to that experience. Because user preferences are so diverse, it is assumed that not all user preferences can be accommodated on every acre of the Apache-Sitgreaves NFs.
- All projects implemented on the forests will require a site-specific assessment of their potential impacts to natural resources and recreation opportunities and settings. The Recreation Opportunity Spectrum (ROS) classes and plan suitability will guide the design and implementation of management activities.
- None of the alternatives has specific objectives to construct new motorized or nonmotorized trails or to designate new motorized use areas during the life of the plan. Proposals would be considered through project-level planning. The environmental consequences of new motorized or nonmotorized trails or motorized use areas would be identified and analyzed at the project level.
- Any new recreation development and maintenance of existing recreation facilities and trails will be constrained by future budgets and may be affected by changing Forest Service and Apache-Sitgreaves NFs priorities.
- Following the finalization of the revised plan, the public motorized travel management plan will be completed and the motorized vehicle use map (MVUM) will be printed. These documents will implement the Travel Management Rule (36 CFR § 212) and prohibit motorized cross-country use except where designated or authorized.

Affected Environment

Overall Recreation Opportunities

Recreation use has increased steadily throughout the history of the national forests. Over the past few decades, the growth in recreation in the Nation has been extraordinary. For example, participation in camping increased from about 13 million people in 1960 to almost 58 million people in 1994/1995 (Cordell et al., 2004). Between 2000 and 2007, the total number of recreation activity days increased approximately 25 percent (Cordell et al., 2008a). The activities of viewing and photographing birds, day hiking, backpacking, off-highway motor vehicle (OHV) driving, walking outdoors, and canoeing/kayaking have seen the greatest growth in the last two decades (Cordell et al., 2009). A survey conducted in 2006 identified the top five outdoor recreation activities that Arizonans participate in: (1) play a sport: baseball, football, soccer; (2) on your feet activity: hike, backpack, jog; (3) drive for pleasure, sightseeing; (4) ride a bicycle, mountain bike, or horse; and (5) visit a park or natural or cultural feature (Arizona State Parks, 2007).

In Arizona, where more than 42 percent of the land base is managed by Federal agencies for public use, the population increased about tenfold since 1940 to more than 5 million people in 2000. In 2005, the State’s population had increased to more than 6 million. The proportion of

Arizonans living in urban areas has changed. In 1900, less than 20 percent of the State’s population lived in an urban setting; in 2000, more than 88 percent of Arizona residents lived in urban settings. The makeup of the State’s population is expected to change with an increasing proportion of elderly and a decreasing number of children under the age of 18. The demographic makeup of Arizona is becoming more diverse; although predominantly white, the second largest segment is Hispanic.

The forests receive approximately 2 million visitors per year; 93 percent are from Arizona (Forest Service, 2006). Approximately 70 percent of the Arizona visitors are from the Phoenix and Tucson metropolitan areas, 19 percent are from counties that make up the forests (Apache, Coconino, Greenlee, and Navajo), and 4 percent are from counties adjoining the forests (Graham and Gila) (Kocis et al., 2002). The majority of all forest visitors are male (approximately 73 percent) and predominantly white (estimated 89 percent). Spanish, Hispanic, or Latino visitors make up approximately 8 percent of total visits, while Native American and Asian users each compose only about 0.8 percent of visits. About 21 percent of users are under the age of 16, while relatively few visitors are between 16 and 30 or over 70 years old. An estimated 63 percent of visitors are between the ages of 31 and 70 (Kocis et al., 2002).

The forests’ visitors, including those that view wildlife, hunt, and fish, contribute significantly to the economic well-being of the surrounding areas. The forests’ contribution to the local economy from the recreation and wildlife economic contribution areas is approximately 69 percent of the local jobs and 68 percent of the local labor income (Forest Service, 2009a). Additional social and economic information can be found in the “Socioeconomic Resources” section, the Economic and Social Sustainability Assessment (Forest Service, 2009a), and the Socioeconomic Resources Report (Forest Service, 2014c).

Nearly all forest visitors, regardless of their reasons for visiting the forests, use the motorized transportation system to reach their destination. Visitors to the Apache-Sitgreaves NFs access the forests on a variety of State and Federal Highways. U.S. Highway (U.S.) 60 and State Highways (SHs) 87 and 260 are the primary routes from the Phoenix metropolitan area. SHs 77, 277, and 377 and U.S. 180 and 191 provide access from Interstate 40 to the north. Access from New Mexico to the east is via U.S. 60 and 180. U.S. 191 traverses the entire length of the Apache NF from north to south. SH 260 crosses the forests from the Mogollon Rim to Eagar (see figure 1).

The Apache-Sitgreaves NFs offer a wide array of dispersed, developed, motorized, and nonmotorized recreation opportunities. Visitors come to the forests to engage in a variety of activities (table 110). The primary recreation activities are “relaxing and escaping the heat,” fishing, hiking, OHV use, viewing natural features and wildlife, camping, driving for pleasure, picnicking, and large group gatherings. Other activities, including boating and hunting, occur on the forests. A majority of these activities occurs in the ponderosa pine, wet mixed conifer, and dry mixed conifer forests, which make up approximately 46 percent of the Apache-Sitgreaves NFs. Visitors use the forests as a place to stay overnight more than any other forest in the National Forest System (Stynes and White, 2005). Outfitters and guides, under permit by the Forest Service, operate on the forests and provide services to the recreating public.

Table 110. Percent participation in activities and primary activities of Apache-Sitgreaves NFs' recreation visitors (Kocis et al., 2002)

Activity	Percent Participation[a]	Percent Who Indicated as Primary Activity
General-relaxing, escaping noise and heat	84.2	41.3
Viewing natural features (scenery) on NFS lands	79.3	3.5
Viewing wildlife on NFS lands	73.5	1.0
Hiking or walking	62.2	8.7
Driving for pleasure on roads	53.3	3.2
Fishing–all types	50.5	19.6
Picnicking and day gatherings in developed sites	47.8	1.5
Camping in developed sites	35.7	7.2
Gathering mushrooms, berries, firewood, etc.	27.6	0.2
Primitive camping	19.4	3.3
Visiting nature center or visitor information services	18.3	0.5
Resorts and cabins on NFS lands	13.7	0.0
Bicycling, including mountain bikes	11.5	0.3
Off-highway vehicle travel	11.3	4.0
Visiting historic and prehistoric sites	11.0	0.1
Other nonmotorized activities (swimming, sports)	6.9	0.9
Motorized water travel (boats, jet skis)	6.8	0.2
Nonmotorized water travel (canoe, raft)	6.4	0.0
Nature study	4.8	0.0
Backpacking and camping in unroaded areas	4.0	0.1
Horseback riding	3.4	0.4
Hunting–all types	3.0	1.3
Other motorized land/air activities (plane, other)	1.1	0.0
Downhill skiing or snowboarding	0.1	0
Snowmobile travel	0	0
Cross-country skiing, snowshoeing	0	0

[a] More than one activity could be checked.

The forests are known for their back-country opportunities including Mount Baldy, Escudilla, and Bear Wallow Wilderness areas, the Blue Range Primitive Area, and over 300,000 acres of inventoried roadless areas.

Visitors are drawn to the abundant water on the Apache-Sitgreaves NFs, a unique feature in the arid Southwest. The Apache-Sitgreaves NFs have over 30 lakes and reservoirs and more than

1,000 miles of rivers and perennial streams, more than can be found on any other southwestern national forest.

Over 35 percent of Arizonans participate in outdoor winter recreation activities (Arizona State Parks, 2007). The Apache-Sitgreaves NFs are a destination for winter activities including snow play, snowmobiling, ice fishing, cross-country skiing, and sledding. In 2001, it was estimated that 0.1 percent of forest visitors used designated snowmobile routes and 1.5 percent used snow play areas during their visits (Kocis et al., 2002). Availability of winter recreation fluctuates from year to year, depending on weather and associated snow levels.

Recreation Opportunity Spectrum

Recreation opportunities on the forests are identified and managed through the recreation opportunity spectrum (ROS). A recreation opportunity is defined as "the availability of a real choice for a user to participate in a preferred activity in a preferred setting, in order to realize desired experiences" (Forest Service, 1982). ROS is a method used to categorize, evaluate, and monitor settings and opportunities based on the natural, managerial, and social environments. Six ROS classes currently apply to NFS lands: primitive (P), semi-primitive nonmotorized (SPNM), semi-primitive motorized (SPM), roaded natural (RN), rural (R), and Urban (U) (Forest Service, 1982). These classes are described in the "Glossary."

An ROS inventory is helpful in establishing baseline condition for recreation settings. It is a management tool used in forest and other broad-scale planning. ROS can be used to show the general effects of alternatives to recreation settings and opportunities over broad classes (Forest Service, 2009a). Figure 52 shows a generalization of the spectrum and its components.

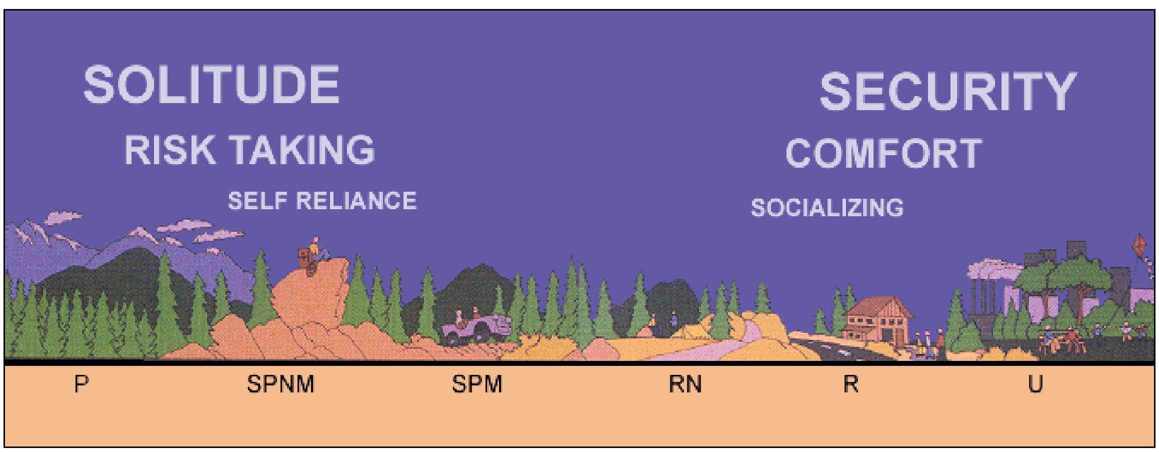

Figure 52. The Recreation Opportunity Spectrum (Forest Service, 1990)

Another way to look at ROS is through the differences in the types of activities and facilities visitors can expect to find in each of the settings. For example, all-terrain vehicle (ATV) riding would be an appropriate activity in SPM through R ROS classes, but it would not be consistent with P or SPNM settings. Activities such as horseback riding or hiking may be acceptable in all ROS classes, but the trails available could vary greatly with the ROS class. Paved trails would not be found toward the "P" end of the spectrum, but they could be common at the more developed end.

Dispersed Recreation

Dispersed recreation is where visitors are spread over relatively large areas, especially in the ponderosa pine, wet mixed conifer, and dry mixed conifer forests on the Apache-Sitgreaves NFs. Some examples of dispersed recreation are hunting, fishing, camping, hiking, sightseeing, driving for pleasure, snowmobiling, cross-country skiing, wildlife viewing, and picnicking. Where facilities (e.g., trailheads, fishing sites, scenic overlooks) are provided, access and protection of the environment are the focus rather than the comfort or convenience of visitors. Visitors to the Apache-Sitgreaves NFs participate in a variety of dispersed recreation activities. There are over 150 dispersed recreation facilities on the forests.

Developed Recreation

Developed recreation refers to areas where the Forest Service provides facilities for concentrated public use. There are over 120 developed recreation sites on the Apache-Sitgreaves NFs (see table 111). There are 58 developed campgrounds, offering single family, multifamily, and large group campsites. Over 35 percent of forest visitors use developed campgrounds (Kocis et al., 2002). Concessionaires, under contract to the Apache-Sitgreaves NFs, operate most of the developed campgrounds. Other developed recreation opportunities include picnic areas, boating ramps, and visitor centers. The forests also partner with Arizona State Parks, Arizona Game and Fish Department, and the City of Show Low to operate Fools Hollow Lake.

Table 111. Types and numbers of developed recreation sites on the Apache-Sitgreaves NFs (Forest Service, 2011b)

Developed Recreation Site Type	Number of Sites
Boating Site	22
Cabin	1
Campground (Single Family)	51
Campground (Group)	7
Day Use Area	7
Dump Station	2
Horse Camp	1
Interpretive sites, including two visitor centers	13
Organization Site	4
Picnic Site (Single Family)	12
Picnic Site (Group)	1

Forest managers are challenged to maintain existing recreation facilities while providing for human health and safety and protecting the natural resources in the light of declining budgets. In 2007, the forests completed a recreation facility analysis to present the tasks needed over the next 5 years to bring the forests’ developed recreation facilities into alignment with the financial resources available to operate and maintain them to standard. A $2 million backlog of deferred recreation facility maintenance[32] was identified (Forest Service, 2007a). Recently, American Recovery and Reinvestment Act funded projects have helped to reduce this maintenance backlog.

Nonmotorized Recreation

Nonmotorized recreation activities include hiking, mountain bike riding, horseback riding, wildlife viewing, picnicking, hunting, fishing, recreational shooting, cross-country skiing, snowshoeing, and snow play. Approximately 64 percent of Arizonans use nonmotorized trails; while 58 percent use them for the majority of their recreation trail time (Arizona State Parks, 2009). There are approximately 1,000 miles of nonmotorized trails designated for hiking, horseback riding, mountain biking, and cross-country skiing on the Apache-Sitgreaves NFs. There are also over 3,000 miles of roads closed to motor vehicle use on the forests available for nonmotorized recreation.

Motorized Recreation

Motorized recreation involves the use of highway legal vehicles, motorcycles, all-terrain vehicles (ATVs and UTVs), and snowmobiles. Around 2,900 miles of roads and trails are open for public or administrative motorized use (see the “Infrastructure” section for more information). Summers, holidays, and hunting seasons generally have the highest volumes of motor vehicle traffic. Approximately 80 percent of the forests’ land is currently open for motorized cross-country use (Forest Service, 2010c).

The number of off-highway vehicles (OHVs) used in Arizona has risen dramatically. Almost 500,000 households within the State have at least one OHV. Furthermore, as many as 30,000 new ATVs and motorcycles are purchased annually (Forest Service, 2008a; Arizona State Parks, 2009).

In December 2005, the Forest Service issued regulations at the national level, known as the Travel Management Rule (TMR). The TMR was developed in response to the increasing effects of OHV recreation and the potential for OHV use to adversely affect forest and grassland resources. One of the primary purposes of the TMR is to designate roads, trails, and areas where motorized vehicle use can occur and to eliminate motorized cross-country travel on all national forests. The designation of specific routes, trails, and areas for motorized vehicle travel on the Apache-Sitgreaves NFs will not be considered during the plan revision process. It will be addressed in separate analysis through future project-level decisionmaking, including implementation of the TMR.

Special Designations

There are several areas identified to protect their unique qualities that also provide recreation opportunities. These special designations on the Apache-Sitgreaves NFs include scenic byways, national recreation trails, wilderness, primitive area, and eligible and suitable wild and scenic rivers. Scenic byways and national recreation trails are discussed below. Information on wilderness and primitive areas and eligible and suitable wild and scenic rivers can be found in their respective sections.

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[32] Deferred maintenance is the postponing of repairs or maintenance due to the lack of financial resources, which results in a decline of the condition or value.

Scenic Byways

Three scenic byways (figure 53) pass through the Apache-Sitgreaves NFs: Coronado Trail National Scenic Byway, From the Desert to Tall Pines Scenic Road, and White Mountain Scenic Road.

In September 2005, the 120-mile Coronado Trail National Scenic Byway, which follows U.S. 191, was designated by the Federal Highway Administration. This route had been a national forest byway and Arizona State scenic byway since 1989, and traverses the Clifton, Alpine, and Springerville Ranger Districts. The byway winds its way from the town of Clifton, to the top of the Mogollon Rim, and through the communities of Alpine and Nutrioso. Vegetation types change with altitude, starting with the Sonoran Desert at the southern end, spruce-fir forest on the Mogollon Rim, and piñon-juniper woodlands at the northern end. There are spectacular views of mountains and rugged country along the entire byway.

The From the Desert to Tall Pines Scenic Road has been a national forest scenic road and Arizona State scenic byway since 1996. Approximately 3 miles (Navajo County Road 512) of this 67-mile scenic road are on the Black Mesa Ranger District. Ponderosa pine forests line this portion of the scenic road from the Mogollon Rim to SH 260.

The 123-mile White Mountain Scenic Road has been an Arizona State scenic byway since 1992 and a national forest byway since 1989. This byway is partially located on the Springerville Ranger District and includes SHs 260, 261, 273, and 373. This byway crosses much of the high elevation grasslands on the forests. These rolling plains are interrupted by forested knolls. Mount Baldy provides a backdrop for the byway.

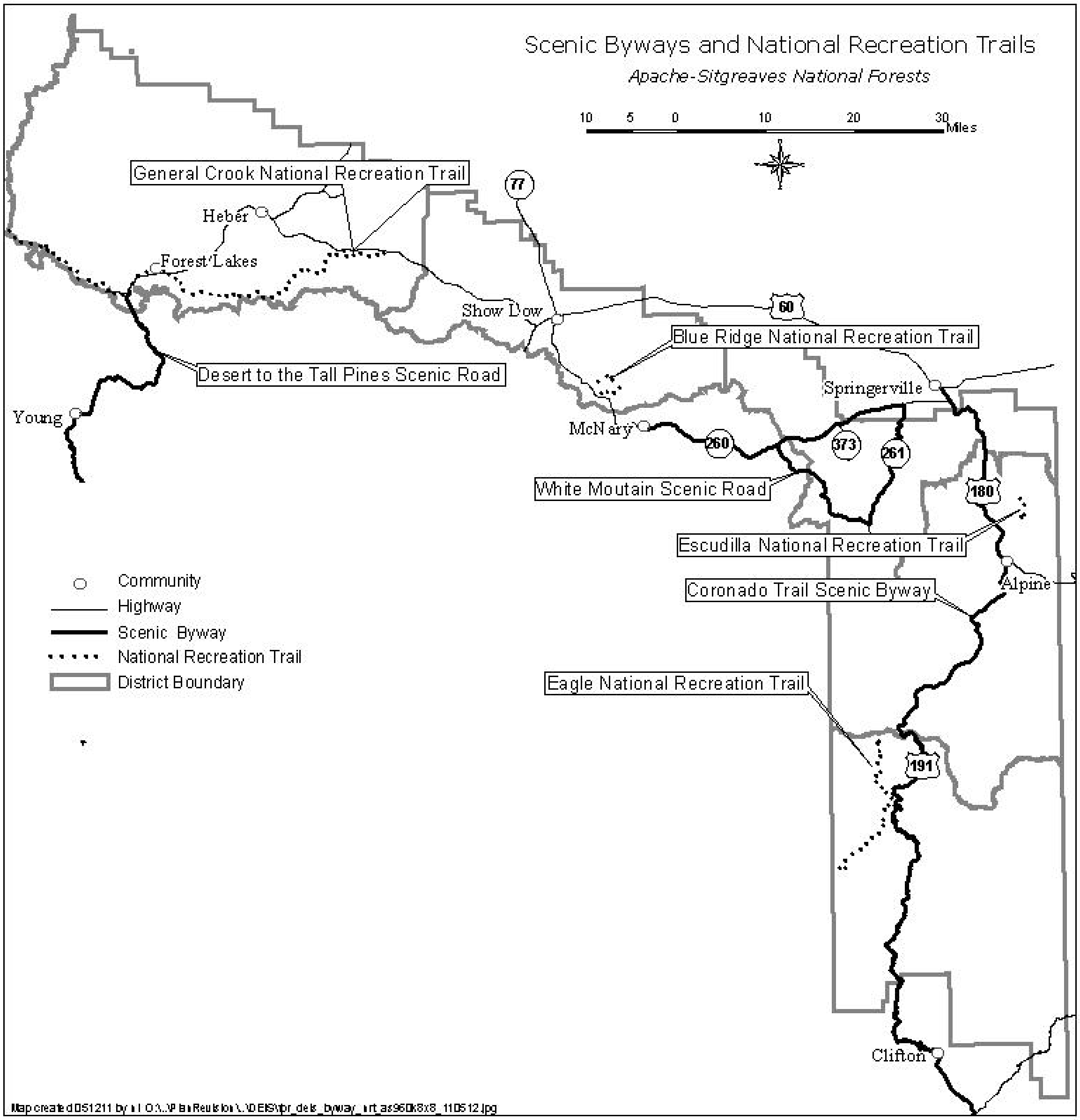

Figure 53. Map of scenic byways and national recreation trails on the Apache-Sitgreaves NFs

National Recreation Trails

The forests have four national recreation trails (NRTs): Blue Ridge, General George Crook, Eagle, and Escudilla (figure 52); all were administratively designated in 1979. NRTs provide a variety of outdoor recreation opportunities and are accessible from urban areas.

The Blue Ridge NRT (Trail 107), located on the Lakeside Ranger District, is approximately 9 miles long. The trail climbs the west side of Blue Ridge Mountain (7,650 feet in elevation) through a mixture of pines, junipers, and many varieties of wildflowers. The mountain itself is a volcanic remnant and provides scenic panoramas from the summit.

Fifty-eight miles of the 114-mile long General George Crook NRT (Trail 140) are located in the Black Mesa and Lakeside Ranger Districts. The trail is part of the route used by General George Crook to deliver supplies to outposts including Fort McDowell, Fort Verde, Camp Reno, Fort Apache, and Camp San Carlos. This route became one of the first major roads in Arizona and was used for decades as a supply and communications route. The original blazes can still be seen on the ponderosa pines lining the trail, as well as occasional traces of homesteads. The trail is popular with equestrians, mountain bikers, and hikers.

Eagle NRT (Trail 79), located on the Clifton Ranger District, is approximately 28 miles long. The northern end of the trail begins on the Mogollon Rim at about 9,000 feet elevation and descends over 4,000 feet through a variety of vegetation types (mixed conifer to riparian) to its southern trailhead adjacent to Eagle Creek Road. The trail traverses several canyons, each with its own unique scenery and vegetation.

Escudilla NRT (Trail 308), located on the Alpine Ranger District, is approximately 3 miles long. The trail ascends Arizona's third highest mountain and is located within Escudilla Wilderness. The trail designation predates the wilderness designation. Forest Service policy discourages national recreation trails in designated wilderness (Forest Service Manual 2353.51 (3)).

Environmental Consequences of Alternatives

Recreation Opportunities

The effect of the changing recreation emphasis by alternative is reflected in the ROS classes. The major ROS emphases in **all alternatives** are for RN, SPM, and SPNM recreation opportunities. Maps of the ROS by alternative can be found in appendix J.

The ROS class acreages for each alternative are summarized in table 112 and shown in figure 54. The U class, although used in **alternative A**, is not appropriate on NFS lands because it represents settings usually found in cities and towns. There are no U acres in the **action alternatives**. Roaded modified (RM) recreation opportunities, shown in the **action alternatives**, are found mainly along a segment of Forest Road 300 on the Sitgreaves NF and reflect the designated dispersed camping and more highly managed recreation opportunities found there.

Table 112. Acres and percent of the forests in each ROS class by alternative

ROS Class	Alt. A Acres (percent)	Alt. B Acres (percent)	Alt. C Acres (percent)	Alt. D Acres (percent)
Urban (U)	104 (0%)	0 (0%)	0 (0%)	0 (0%)
Rural (R)	32,853 (2%)	42,530 (2%)	43,333 (2%)	41,058 (2%)
Roaded Modified (RM)	0 (0%)	9,682 (<1%)	9,682 (<1%)	7,149 (<1%)
Roaded Natural (RN)	686,435 (34%)	603,887 (30%)	645,056 (32%)	539,491 (27%)
Semiprimitive Motorized (SPM)	614,520 (31%)	575,572 (29%)	662,116 (33%)	527,725 (26%)
Semiprimitive Nonmotorized (SPNM)	452,486 (22%)	487,747 (24%)	422,932 (21%)	279,050 (14%)
Primitive (P)	228,954 (11%)	295,934 (14%)	232,233 (12%)	620,879 (31%)
Total	**2,015,352**	**2,015,352**	**2,015,352**	**2,015,352**

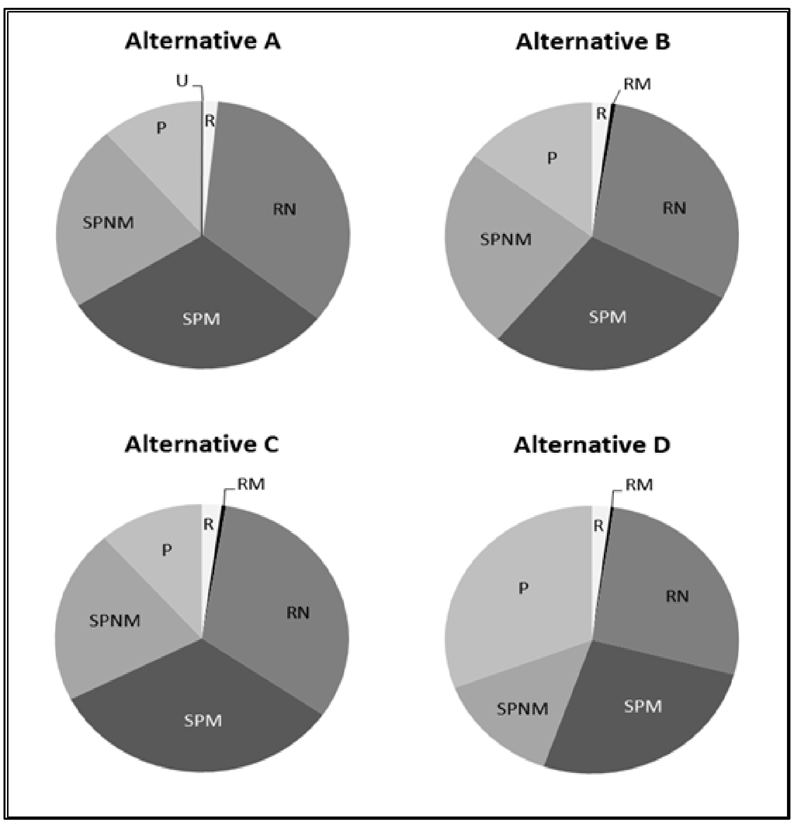

Figure 54. Acres by ROS class by alternative

Alternatives A and C would provide the most acres available for motorized recreation opportunities (R through SPM). **Alternative B** would provide a mix of recreation opportunities, with more nonmotorized recreation opportunities (SPNM and P) than **alternatives A and C**. **Alternative D** would provide the most nonmotorized recreation opportunities (P and SPNM), while maintaining over 1 million acres (over half of the forests) in RN and SPM.

Most SPNM acres in **alternatives A, B, and C** are found on the Clifton Ranger District or are located elsewhere on the forests and are generally not accessible to motorized recreation. In **alternative D**, many of these SPNM acres across the forests are recommended for wilderness and would provide P recreation opportunities.

It is expected that as the recreation emphasis changes with each alternative, the type of user attracted to the forests would change or current users may move to other areas where their desired recreation opportunities are available. In **alternative A**, there is a mix of motorized, nonmotorized, developed, and dispersed recreation opportunities. This mix would continue into **alternative B.** However, motorized cross-country travel would not be allowed in any of the **action alternatives**. With a greater emphasis on motorized and developed recreation opportunities in **alternative C**, there could be a shift toward users who prefer motorized recreation activities and/or developed recreation. There would also be decreases in nonmotorized and dispersed recreation opportunities that could displace users to other areas or result in fewer users who prefer those types of recreation. **Alternative D**, with a greater emphasis on nonmotorized and dispersed recreation opportunities, may attract those who prefer nonmotorized and/or dispersed recreation activities, while not encouraging those with motorized/developed preferences. In **alternatives C and D**, users may be displaced and may look to recreate in other locations off the Apache-Sitgreaves NFs or may “stay home” (Kocis et al., 2002).

Effects of Management Activities on Recreation

In **all alternatives**, management activities, especially mechanical vegetation treatments, may affect recreation users by displacing them from the treated areas. Displacement could affect both developed and dispersed users. For developed recreation, there could be a short-term closure of a campground, displacing users to other developed sites or long-term displacement if the developed site character is no longer what a recreationist desires. For example, thinning trees in a campground may reduce vegetative screening between campsites, which may affect a sense of privacy.

For dispersed recreation, short-term displacement could result from the presence of logging equipment or slash piles prior to and shortly after burning. Longer term dispersed displacement could result from changes to a dispersed campsite or use area. For example, an area would generally be more open and a campsite may be visible if within sight of a road. The loss of vegetative screening between a dispersed campsite and a main road (maintenance level 3 or 4) would probably result in increases in dust and noise and decreases in privacy.

Prescribed fires and wildfires would also displace recreation users. However, this displacement could be of an intermediate length, because users may not return to an area for several months after burning or until some vegetation has regrown.

Mechanical vegetation treatments and the use of wildland fire would displace both motorized and nonmotorized recreation users. Areas where these treatments are occurring may be closed for public safety or have limited access. Displacements would be similar to those described above. The length of displacement would vary by treatment type, amount of slash and debris piles, vegetation regrowth after prescribed fire, and scenic quality.

Dispersed Recreation

Dispersed recreation on the Apache-Sitgreaves NFs during the high use summer season occurs mostly in the ponderosa pine, wet mixed conifer, and dry mixed conifer forests, which are the primary emphasis for vegetation treatments. Because the majority of the proposed vegetation treatments would occur in areas used for dispersed recreation, dispersed recreationists, especially campers, would be affected more than developed recreation users. On an average annual acres treated basis (table 113), dispersed users would be displaced the most under **alternatives C and D** and the least under **alternative A**. However, long-term displacement effects would be greater under **alternative C** because of the higher proportion of mechanical treatments.

Table 113. Average annual treatment objectives (acres) in ponderosa pine, wet mixed conifer, and dry mixed conifer forested PNVTs by alternative

PNVT	Treatment	Alt. A Acres	Alt. B Acres	Alt. C Acres	Alt. D Acres
Ponderosa Pine	Mechanical	7,119	6,289	13,341	5,434
	Wildland Fire	3,150	6,300	5,614	12,679
Wet Mixed Conifer	Mechanical	2,147	1,900	4,023	1,640
	Wildland Fire	950	1,900	1,725	3,824
Dry Mixed Conifer	Mechanical	1,808	1,584	3,388	1,380
	Wildland Fire	800	1,663	1,525	3,381
Total	Mechanical	11,074	9,773	20,752	8,454
	Wildland Fire	4,900	9,863	8,864	19,884
Grand Total	Mechanical and Wildland Fire	15,974	19,636	29,616	28,338

It is not anticipated that winter recreation users would be displaced because treatments generally occur during non-winter months, the short-term slash and burn piles may be covered by snow, and winter users usually stay in overnight facilities off the forests. Thinned areas may attract winter recreationists because of the openness.

Developed Recreation

All alternatives would provide a wide range of recreation opportunities across the Apache-Sitgreaves NFs; however, the emphasis varies by alternative. **All alternatives** emphasize the maintenance of existing recreation infrastructure or facilities. **Alternative A** identifies 1,665 acres as a management area for developed recreation sites; these acres are not mapped. The **action alternatives** would include the High Use Developed Recreation Area (HUDRA) Management

Area (16,549 acres) (see management area map in appendix J). This management area contains areas with high levels of recreation use and concentrated use areas where facilities have been constructed to accommodate large numbers of people (e.g., Big Lake Recreation Area). These areas are large enough to allow for construction of additional facilities.

Alternative A would emphasize developed recreation with the addition of new facilities. **Alternative B** proposes a balance of motorized and nonmotorized opportunities, with the possible construction of dispersed facilities, such as trails and interpretive sites. **Alternative C** would place a greater emphasis on motorized recreation and developed facilities. Motorized recreation opportunities would be improved with the development of trails and interpretive sites. New developed recreation facilities could be constructed in the HUDRA Management Area. **Alternative D** would focus on nonmotorized and dispersed recreation opportunities that require minimal facilities. Under **all alternatives**, any new recreation facility would be further considered in site-specific, project-level analyses that would consider other resources, including, but not limited to, soil, vegetation, water, cultural resources, and wildlife.

Alternatives A and C would provide the most opportunities for developed and/or motorized recreation, while **alternative D** would provide the least. **Alternative B** would provide moderate opportunities for developed and/or motorized recreation.

Although maintenance of the existing recreation infrastructure and reduction of the deferred maintenance backlog (by 10 percent within the planning period) are components of **all alternatives**, there are different consequences by alternative. This hinges on the assumption that funding for recreation facilities and their maintenance does not vary by alternative. Under **alternatives A and C**, it would be difficult to achieve the deferred maintenance objective because **alternative A** focuses on the development of new facilities and **alternative C** emphasizes developing new facilities and/or enhancing existing facilities in the HUDRA Management Area. If funds are spent on new and/or enhanced facilities, then maintenance of existing facilities could be further deferred. **Alternative B** should meet the deferred maintenance backlog objective because new facility development would be limited. **Alternative D** would also meet the objective with its minimal new construction emphasis.

Nonmotorized Recreation

Future Consideration of New Nonmotorized and Mechanized Recreation

There would be no effects to nonmotorized recreation in **all alternatives** because the entire forests are suitable for nonmotorized travel. Also, approximately 85 percent of the forests are suitable for future consideration of mechanized travel (e.g., mountain bikes) in **all alternatives**. **Alternative A** could provide the most mechanized travel opportunities; while **alternatives B, C, and D** could provide fewer (3 percent less) opportunities.

Acres suitable for nonmotorized recreation are shown in table 114. **Alternative A** is based on management area direction in the 1987 plan. The **action alternatives** are based on suitability criteria found in chapter 4 of the proposed plan. The suitable acres in the **action alternatives** vary because of the different allocations of land to management areas (table 2) and management area direction. Mechanized and nonmotorized suitability would be further refined in site-specific, project-level analyses that would consider other resources including, but not limited to, soil, riparian, water, cultural resources, and wildlife.

Table 114. Acres suitable for future consideration of mechanized and nonmotorized travel by alternative

Travel Type	Alt. A Acres (percent)	Alt. B Acres (percent)	Alt. C Acres (percent)	Alt. D Acres (percent)
Mechanized	1,748,869 (87%)	1,688,649 (84%)	1,696,532 (84%)	1,705,034 (85%)
Nonmotorized	2,015,352 (100%)	2,015,352 (100%)	2,015,352 (100%)	2,015,352 (100%)

Motorized Recreation

Future Consideration of New Motorized Areas and Trails

Under **all alternatives,** over half of the forests could be suitable for future consideration of new motorized areas and trails. The most land that could be suitable occurs in **alternatives A and C**, followed by **alternative B;** while the least that could be suitable is in **alternative D**. Alternatives with more suitable acres could provide additional forest access for motorized users that, in turn, could discourage nonmotorized use in those areas. Should new motorized areas and trails be implemented, site-specific effects to resources could occur, but they should be mitigated through the use of standards, guidelines, and best management practices (BMPs).

Acres suitable for future consideration of new motorized recreation development by alternative are summarized in table 115. **Alternative A** is based on management area direction in the 1987 plan. The **action alternatives** are based on suitability criteria found in chapter 4 of the proposed plan, which defines whether or not a management area is suitable for future consideration of a variety of motorized uses. The motorized use suitability would be further refined during project-level analyses that would consider other resources, including, but not limited to, soil, riparian, water, cultural resources, and wildlife. See the “Infrastructure” section for a discussion of new motorized roads.

Table 115. Acres and percent suitable for future consideration of new motorized areas and trails by alternative

Category	Alt. A Acres (percent)	Alt. B Acres (percent)	Alt. C Acres (percent)	Alt. D Acres (percent)
New Motorized Areas	1,423,242 (71%)	1,243,316 (62%)	1,572,507 (78%)	1,095,135 (54%)
New Motorized Trails	1,444,430 (72%)	1,273,822 (63%)	1,619,298 (80%)	1,123,081 (56%)

Motorized Cross-country Travel

Alternative A would continue to allow motorized cross-country travel. Environmental consequences of continuing this use are described below.

Increased motorized cross-country travel from a growing user population would result in more resource damage, more conflicts with other forest users, safety concerns, higher noise levels, additional user-created routes, and new dispersed camping locations, especially in or near riparian areas. Nonmotorized visitors could be displaced by noise and conflicts with motorized hunters and recreationists to other parts of the forests and to areas that are closed to motorized cross-country travel.

Unmanaged motorized cross-country travel has the potential to adversely affect scenic quality through resource damage (e.g., vegetation crushing, soil erosion). This is especially important in locations where physical impacts should be subordinate to the natural landscape. Unauthorized routes would continue to be used and their numbers could rise with increasing recreational use of the forests. Because unauthorized use is not managed and is likely to increase, the overall scenic quality would decline.

Motorized cross-country travel would increase the potential for erosion, reduce soil productivity due to compaction and erosion, destroy vegetative cover and natural ground litter, damage riparian areas, increase sediment in streams and water bodies, and change surface flow. Cross-country motorized travel also destroys biological soil crusts. Streambank damage could occur at vehicle crossings and along streams in recreation areas. Surface water quality could be reduced from sedimentation, increased turbidity, introduction of motor vehicle fluids from spills and leaks, and direct contact of vehicles with streams and water bodies.

Resource damage could occur in all vegetation types, especially riparian areas, and may damage or kill individual rare plants. Motorized cross-country travel has the potential to transport nonnative, invasive plant species seeds throughout the forests, thereby greatly expanding the extent of their occurrence.

Motorized cross-country travel expands access to areas and may result in wildlife mortality (e.g., illegal shooting, vehicular collision); influence wildlife behavior, survival, reproduction, and distribution of species; and alter habitats.

Growing motorized cross-country use increases the potential impacts to streams and fish from erosion and sedimentation. This use directly damages riparian and aquatic habitats and fish life stages when their mobility is limited. These uses indirectly affect downstream habitat primarily through increased sediment and decreased water quality.

Unrestricted motorized access to remote sites increases the potential for vandalism, including illegal excavation (looting), damage or destruction to standing architecture or rock art, and collection of surface artifacts. Motorized use may remove vegetation that protects and covers archaeological materials. When cultural materials are exposed, the more decorative artifacts and collectable historic objects may disappear through illegal collecting.

The **action alternatives** would eliminate motorized cross-country travel. Motorized travel would be limited to NFS roads, NFS motorized trails, and designated motorized areas. Certain vehicles and uses are exempted from the suitability determination per Executive Order 11644 (e.g., vehicles used for emergency purposes, vehicles allowed by permit or contract). Eliminating motorized cross-country travel would have beneficial effects to soils, water, vegetation, fish, wildlife, and cultural resources by removing some of the negative consequences listed above. Additional environmental consequences are described below.

Motor vehicle use would only be allowed on roads, trails, and areas designated for motorized use. This would make it easier for forest users to understand where they can travel with motor vehicles. Not having motor vehicles on unauthorized user-created routes would reduce safety concerns.

There could be some displacement of motor vehicle users to lands outside the Apache-Sitgreaves NFs where motorized cross-country travel may be allowed. Additional impacts to scenic integrity from motorized cross-country travel would be prevented. Unauthorized routes would revegetate and scenic integrity would improve.

Plants and their habitats would benefit from reduced disturbance. The potential to spread nonnative, invasive plant species seeds across the forests would be reduced. By reducing where motor vehicles are allowed, rare plant habitat quality would improve by minimizing vehicular crushing and invasive plant introductions.

Erosion and sediment transport would be reduced as disturbed areas revegetate. Less sediment would reduce maintenance needs of road related structures (culverts) and improve downstream aquatic habitats. Better watershed conditions would reduce peak flows and promote better infiltration and groundwater recharge.

Less motorized access may reduce disturbance, mortality (e.g., fewer collisions), and habitat fragmentation and modification, and it may improve habitat security and quality. Potential impacts and disturbance to fish species, riparian and aquatic habitats, and hydrologic conditions would be reduced.

The potential to disturb cultural resources would be reduced because fewer lands would be open to motor vehicle use, resulting in a beneficial effect to cultural resources. The adverse effects to remote cultural sites from motorized cross-country travel would be reduced and, in some areas, stopped.

In **all alternatives**, motorized travel would be limited to a system of designated roads, trails, and areas after the completion of travel management planning process to implement the Travel Management Rule.

Special Designations

No new scenic byways or national recreation trails (NRTs) are proposed in **any alternative**. The current scenic byways and NRTs would continue to be managed to protect the values for which they were designated. There would be no effects from removing the NRT designation from Escudilla Trail, as proposed in the **action alternatives**, because it is within a designated wilderness.

Cumulative Environmental Consequences

The cumulative effects analysis area for recreation is the Coconino NF, the Tusayan and Williams Districts on the Kaibab NF, the Payson and Pleasant Valley Ranger Districts on the Tonto NF (Forest Service, 2010i), and other Federal and State managed lands within a 20-mile radius of the Apache-Sitgreaves NFs. This large area was selected because of ongoing and proposed activities on neighboring national forests (i.e., Four Forest Restoration Initiative), adjacent State lands (i.e., recreation permits, types of recreation limited), and neighboring American Indian reservations (i.e., recreation permits, types of recreation limited).

Under the Four Forest Restoration Initiative (4FRI), up to 50,000 acres across four national forests in Arizona (Apache-Sitgreaves, Coconino, Kaibab, and Tonto) may be thinned and/or prescribed burned per year for 20 years, primarily in ponderosa pine and dry mixed conifer forests, a total of 1 million acres. As previously discussed, much of the summer recreation on national forest lands occurs in these forested PNVTs. Because of the extent of the proposed activities, in addition to other ongoing vegetation treatments on the Apache-Sitgreaves NFs in **all alternatives**, there would be cumulative effects to recreation. Recreation users of the forests, especially dispersed users, could be displaced to areas beyond the national forests in Arizona, to forest lands in other states, or to lands managed by other agencies. It is also possible that forest users may choose to no longer recreate beyond their home area (Kocis et al., 2002). This could result in losses in revenues to communities within or adjacent to the four national forests involved with 4FRI.

In **all alternatives**, cumulative effects to recreation could also result from other agencies' management of their lands. In particular, permits are required for recreational use of surrounding American Indian reservations and State trust lands. A fee is charged for the permit and only limited recreation activities are allowed. The fee and the limitations on types of recreation could both negatively and positively affect recreation use on the Apache-Sitgreaves NFs. Those recreation users unwilling or unable to pay a fee would use the forests rather than reservation or State lands. Also, those users whose preferred activities are not allowed on adjoining lands would select to visit the forests. Conversely, those users seeking a different recreation opportunity would pay the fee to visit the lands surrounding the forests. For example, a camper wishing a dispersed recreation opportunity without the presence of ATVs may opt to pay for and visit the Fort Apache Indian Reservation, because the White Mountain Apache Tribe does not allow the use of ATVs on their lands.

The Arizona Department of Transportation (ADOT) 2014–2018 Five-Year Transportation Facilities Construction Program lists projects on or in the vicinity of the Apache-Sitgreaves NFs. These planned projects consist of pavement rehabilitation, shoulder widening, and other heavy maintenance activities. None of these projects would increase or decrease access to the Apache-Sitgreaves NFs. In **all alternatives**, these road improvements could facilitate increases in forest visitors since the driving times from the urban areas of Phoenix and Tucson would decrease. As use increases, compliance with regulations could become a greater challenge as recreation participants often compete for limited space and resources. Especially vulnerable are semi-primitive and primitive settings, which emphasize solitude, challenge, risk, unmodified natural environments, and minimal encounters and/or signs of other users.

See the "Socioeconomic Resources" section for additional cumulative environmental consequences.

Infrastructure

This section summarizes the existing transportation system on the forests. It also describes the Apache-Sitgreaves NFs' owned administrative facilities. It displays the potential environmental consequences that may result from implementing the four alternatives. Motorized trails are addressed in the "Recreation" section. The full analysis for this section can be found in the "Infrastructure Specialist Report" (Forest Service, 2014j) available in the "Plan Set of Documents."

The criteria for comparing alternatives includes a discussion of how plan direction varies to address riparian-related resource damage, how motorized cross-country travel is managed, and the amount (acres) of land suitable for new motorized route construction. Assumptions and key policies used in the analysis include the following:

- None of the alternatives has specific objectives, during the life of the plan, to construct new motorized routes and/or designate new motorized areas. Proposals for new development and the associated environmental effects will be considered through project-level planning.
- New motorized routes would not be constructed in designated wilderness areas, the Blue Range Primitive Area, inventoried roadless areas (IRAs), and other areas considered not suitable for new motorized route construction.
- The land shown as suitable for future consideration of new motorized routes or motorized areas does not reflect site-specific resource concerns (e.g., slope, soils, cultural resources) that will be addressed in project-level analysis.
- Generally, the current road maintenance levels are not expected to change over the life of the plan. There may be some exceptions, for example the portion of Forest Road 300 from State Highway 60 to State Highway 260. It currently ranges in maintenance levels of 2 through 3. As funding allows, this section of road would be managed at maintenance level 3 for consistency in maintenance activities, signing, and vehicle use.
- NFS roads no longer needed for current or future use will be decommissioned by re-contouring, ripping, and seeding as appropriate and will be analyzed on a project-level basis.

Affected Environment

Motorized Routes

The transportation system on the Apache-Sitgreaves NFs consists of roads and trails that provide people with access to public lands and private inholdings. Motorized travel on the forests has evolved over time. Historically, the road system on the Apache-Sitgreaves NFs was constructed for commodity access, primarily timber harvest, livestock production, mining, and administration. Some roads were alternate routes that connected small communities and some were used to access points of interest or areas used for specific activities, such as hunting and camping. While the transportation system continues to provide access for administration of the forests, the majority of use today comes from public recreation and forests products extraction.

The motorized transportation system comprises 765 miles of roads open only to highway legal vehicles (maintenance level 3 through 5), 2,067 miles of roads open to all motorized vehicles (maintenance level 2), 3,372 miles of roads closed to all motorized vehicles (maintenance level 1), and 156 miles of trails open to motorized vehicles less than 50 inches wide. The miles of open motorized transportation system includes roads with access restricted on a seasonal basis for public safety and to minimize resource damage.

Additional travel ways exist that are not part of the NFS road network and are considered unauthorized routes. An inventory has not been completed, but it is estimated that there are hundreds of miles of unauthorized routes. These unauthorized routes include unplanned, abandoned travel ways; user-created routes; and roads that were once under permit or other authorization and were not decommissioned upon termination of the authorization. Travel ways in this category are awaiting management evaluation as to whether or not to include them as part of the transportation system or to decommission.

Over the last few decades, funding has been insufficient to maintain all NFS roads and NFS motorized trails to appropriate standards to meet the road and trail management objective levels. Generally, the funding received has been focused on maintenance of higher standard roads that serve multiple-access needs. There is currently a backlog of road maintenance referred to as “deferred maintenance” or tasks that are the cumulative total of all annual maintenance tasks not accomplished as needed or scheduled. Maintenance items include, but are not limited to, surfacing, drainage and drainage structures, and closure structures. Deferred maintenance on the Apache-Sitgreaves NFs road system has accumulated to over $50 million.

Generally, new road construction may occur when access to a particular resource or private inholding is needed. These roads may be permanent, if intended for long-term use, or they may be temporary and then removed. Any adjustments to the road network would be made, as necessary, during project-level planning.

Less than 10 miles of new NFS road construction has occurred over the past 5 years. It has been limited to relocation of poorly located roads (e.g., near riparian areas, wet meadows) and developed campground construction. Temporary roads have been used for forest products extraction where a permanent road is not needed for future access.

The use of motorized vehicles for recreation activities has increased dramatically in recent years (Arizona State Parks, 2007). Advances in the performance and the technology of off-highway vehicles (OHVs), all-terrain vehicles (ATVs), and utility-terrain vehicles (UTVs) have increased the demand for additional motorized recreation trails (i.e., motorized routes less than 50 inches wide), specifically connectors between routes to create loops.

Approximately 1,480,000 acres (about 70 percent) of the forests are currently open to motorized cross-country travel. The three designated wilderness areas and the Blue Range Primitive Area are closed to motorized cross-country travel.

Administrative Facilities

The Apache-Sitgreaves NFs’ administrative facilities consist of one air tanker base to support wildfire suppression, five ranger district offices, quarters for seasonal employees and crews, warehouses, barns, residential housing, engine bays, storage facilities, and associated water and wastewater systems. Over the past several years, management emphasis has been to reduce the square footage of administrative facilities and still meet the needs of the forests. A facility master plan was completed in 1994 with subsequent annual updates. The facility master plan guides acquisition, maintenance, and disposal of facilities. It identifies facility needs and guides decisions regarding proposed and existing facilities.

Environmental Consequences of Alternatives

Motorized Routes

In **alternative A**, management of the motorized transportation system would be guided by direction in the 1987 plan, which was driven primarily by timber harvesting. There are no specific objectives that would address motorized routes that may be adding sediment to streams or causing riparian related resource damage.

All of the **action alternatives** would contain direction for roads and motorized trails that include specific objectives within the planning period to remove unauthorized routes and close maintenance level 1 roads in riparian areas. These alternatives would also include specific objectives within the planning period to close, re-contour, and/or revegetate unauthorized routes and maintenance level 1 roads that directly add sediment to streams or cause damage to riparian systems. As a result of these actions, there would be fewer roads, trails, and unauthorized routes that directly add sediment to streams, damage riparian vegetation, erode stream banks, cause gullies, and/or compact floodplain soils.

In **alternative A,** motorized cross-country travel is allowed in most areas. It would be expected that with increasing populations, motorized cross-country travel would increase resulting in mixed user conflicts and creation of even more miles of unauthorized routes. Maintenance and deferred maintenance costs would increase as additional miles of unauthorized routes need to be removed or reconstructed according to best management practices (BMPs) to reduce resource damage and design standards for user safety.

All of the **action alternatives** would prohibit motorized cross-country travel, except where authorized. Exceptions include emergency vehicles, snowmobiles, and permitted uses (e.g., livestock grazing, firewood permits). Eliminating motorized cross-country travel except where authorized would make current funding used to mitigate resource damage from unauthorized routes available for existing NFS road maintenance. Motorized vehicle use would only be allowed on roads, trails, and areas designated for motorized use, making it less complicated for forest users to understand where they can travel with motorized vehicles and lessening the conflicts between motorized use and nonmotorized use.

Table 116 summarizes the acres suitable for the future consideration of new motorized areas, NFS roads, NFS motorized trails, and temporary roads. This classification does not imply that construction of motorized routes would occur. This table is based on criteria found in the motorized uses suitability section in chapter 4 of the proposed plan for the **action alternatives**. There is no clear direction for new motorized development in **alternative A**, suitability is based on management area emphasis.

Alternative C would provide the greatest amount of acreage suitable for future consideration of new motorized areas, NFS roads, NFS motorized trails, and temporary roads, followed by **alternatives A, B, and D**. Alternatives with higher suitable acres could provide additional forest access for motorized users which, in turn, could discourage nonmotorized use in those areas. If new motorized road or trail construction occurred, maintenance and deferred maintenance costs would increase.

Table 116. Approximate acres and percent of the Apache-Sitgreaves NFs suitable for future consideration of new motorized areas, NFS roads, NFS motorized trails, and temporary roads[a]

Category	Alt. A	Alt. B	Alt. C	Alt. D
New Motorized Areas	1,423,242 (71%)	1,243,316 (62%)	1,572,507 (78%)	1,095,135 (54%)
NFS Road Construction	1,444,430 (72%)	1,276,291 (63%)	1,621,771 (80%)	1,125,553 (56%)
NFS Motorized Trails <50" Construction	1,444,430 (72%)	1,273,822 (63%)	1,619,298 (80%)	1,123,081 (56%)
Temporary Road Construction	1,448,434 (72%)	1,405,288 (70%)	1,696,497 (84%)	1,233,645 (61%)

[a]This table does not imply or propose these activities or level of development would occur but is a measurable way of showing the differences in the alternatives.

Both mechanical and wildland fire treatments are planned in all alternatives. At the average planned treatment objective level, **alternatives C and B**, respectively, would rely on more mechanical treatments to move toward desired condition, followed by **alternative D then A**. Mechanical treatments may require more reconstruction (e.g., curve widening, hardened drainage crossings) of roads to accommodate the design needs of the critical vehicle to perform mechanical treatment than fire treatments would require. Mechanical treatments may also require more construction of temporary roads during the treatment period to access the treatment areas than fire treatments. This may result in mechanical treatments having a higher cost per acre due to motorized access costs. Effects of roads, including temporary roads, are discussed in the affected resource sections including, but not limited to, soil, water, and air.

Activities, such as NFS road maintenance, relocation, and construction of new motorized use areas, NFS motorized trails and NFS roads, should not have an impact on long-term productivity because they would be accomplished using BMPs. Additionally, they should result in conditions that minimize resource impacts while providing needed access to the forests.

Administrative Facilities

The management of the administrative facilities on the Apache-Sitgreaves NFs would not change under **any alternative**. The facility master plan would be reviewed and updated annually as necessary to reflect management needs. Funding would be prioritized to accomplish critical health and safety maintenance and deferred maintenance items.

Cumulative Environmental Consequences

The bounds of analysis are the adjoining national forests, the counties encompassing the Apache-Sitgreaves NFs, and the Arizona State highways (SH) and the designated forest highways that access and traverse the forests.

The Four Forest Restoration Initiative (4FRI) is a landscape-scale restoration project to reduce the threat of high intensity, potentially destructive fires on the Apache-Sitgreaves, Coconino, Kaibab, and Tonto NFs. This project could impact the forests' transportation system because of the need to access the eastern side of the Coconino NF for treatments and/or removal of biomass. In **all**

alternatives, use of these roads would result in increased traffic and a need for more frequent road maintenance. The increase in traffic and the different types of vehicles could require improvement of the road to accommodate these activities safely.

The Arizona Department of Transportation (ADOT) 2014–2018 Five-Year Transportation Facilities Construction Program lists projects on or in the vicinity of the Apache-Sitgreaves NFs. Planned projects consist of pavement rehabilitation, shoulder widening, and other heavy maintenance activities. None of these projects would increase or decrease access to the Apache-Sitgreaves NFs. However, in **all alternatives**, these road improvements could facilitate increases in forest visitors as the driving times to the forests from the urban areas of Phoenix and Tucson would decrease as a result of these improvements. This potential increase of forest visitors using the forest motorized transportation system could result in more frequent road maintenance needs.

There are seven NFS roads designated as forest highways in the Apache-Sitgreaves NFs. In the fall of 2011, the forests submitted two of these roads for funding from the Federal Highways Administration to reconstruct. The reconstruction work would include new drainage structures, road widening, possible realignment of small segments, and paving. The reconstruction of these roads would not increase or decrease access to the forests lands. In **all alternatives**, completion of these projects would eliminate deferred maintenance on these routes and turn over maintenance responsibility to ADOT, freeing up funding to be used on other NFS roads.

Eligible and Suitable Wild and Scenic Rivers

This section describes the rivers currently eligible or suitable for designation into the National Wild and Scenic River System. It also describes the potential environmental consequences on the wild and scenic river resource that may result with the adoption of a revised land management plan. The full analysis for eligible wild and scenic rivers can be found in the "Wild and Scenic Rivers Specialist Report" (Forest Service, 2014w) available in the "Plan Set of Documents."

The number and miles of eligible and suitable rivers do not vary by alternative; however, the management areas which the rivers overlay may change by alternative. Rivers are classified as wild, scenic, or recreational.

- **Wild rivers**: Those rivers or sections of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
- **Scenic rivers**: Those rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational river**s: Those rivers or sections of rivers readily accessible by road or railroad that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

In the analysis for this resource, assumptions include the following:

- All identified river segments and associated corridors are managed in conformance with Forest Service Handbook 1909.12, Chapter 82.5 - Interim Management of Eligible or Suitable Rivers.

- The 2011 Wallow Fire affected all or portions of 12 eligible and suitable wild and scenic rivers. The outstandingly remarkable values for these rivers were reviewed with a focus on the long-term assessment of eligibility because of the changed conditions. This review found the outstandingly remarkable values for each river are still valid and will remain valid into the future (Forest Service, 2012a).

Affected Environment

The Apache-Sitgreaves NFs do not have any designated wild and scenic rivers. However, the forests currently have both eligible and suitable wild and scenic rivers (figure 55).

Eligible Rivers

There are approximately 339 miles of 23 rivers (table 117) eligible to be included in the National Wild and Scenic Rivers System. There are 172 miles classified as wild, 66 miles classified as scenic, and 101 miles classified as recreational. These rivers are located in all ranger districts except Lakeside.

Eligible rivers are managed to retain their status until a suitability determination has been made whether to recommend their inclusion in the National Wild and Scenic Rivers System.

Table 117. Eligible wild and scenic rivers by river classification

River Name	Wild (miles)	Scenic (miles)	Recreational (miles)	Total (miles)
Bear Wallow Creek	3.7	—	0.9	4.6
Black River	18.3	0.5	—	18.8
Campbell Blue Creek[a]	4.1	—	8.0	12.1
Coal Creek[a]	9.6	0.6	7.7	17.9
Dix Creek	—	3.3	—	3.3
Eagle Creek	—	—	19.5	19.5
East Clear Creek[b]	—	21.2	—	21.2
East Eagle Creek	7.5	3.5	3.5	14.5
East Fork Black River	3.3	1.2	8.2	12.7
East Fork Little Colorado River	—	9.3	—	9.3
Fish Creek	—	9.9	0.6	10.5
Little Blue Creek	18.4	—	—	18.4
Leonard Canyon[c]	—	—	23.6	23.6
North Fork East Fork Black River	12.7	1.0	—	13.7
Pigeon Creek	4.8	—	10.3	15.1
San Francisco River	9.0	—	15.0	24.0
Sardine Creek	8.9	—	—	8.9
South Fork Little Colorado River	—	7.3	—	7.3
Turkey Creek	9.1	—	—	9.1
West Fork Black River	8.6	3.0	—	11.6
West Fork Little Colorado River	6.4	—	1.7	8.1
Willow Creek	18.9	—	—	18.9
Woods Canyon - Chevelon Creek	28.4	5.3	2.4	36.1
Total miles	**171.7**	**66.1**	**101.4**	**339.2**

[a]Also located on the Gila NF. Total miles shown.

[b]Also located on the Coconino NF. A portion of this river is the boundary between the Apache-Sitgreaves NFs and the Coconino NF. Miles shown are the common boundary.

[c]Also located on the Coconino NF. Miles shown are the common boundary between the Apache-Sitgreaves NFs and the Coconino NF.

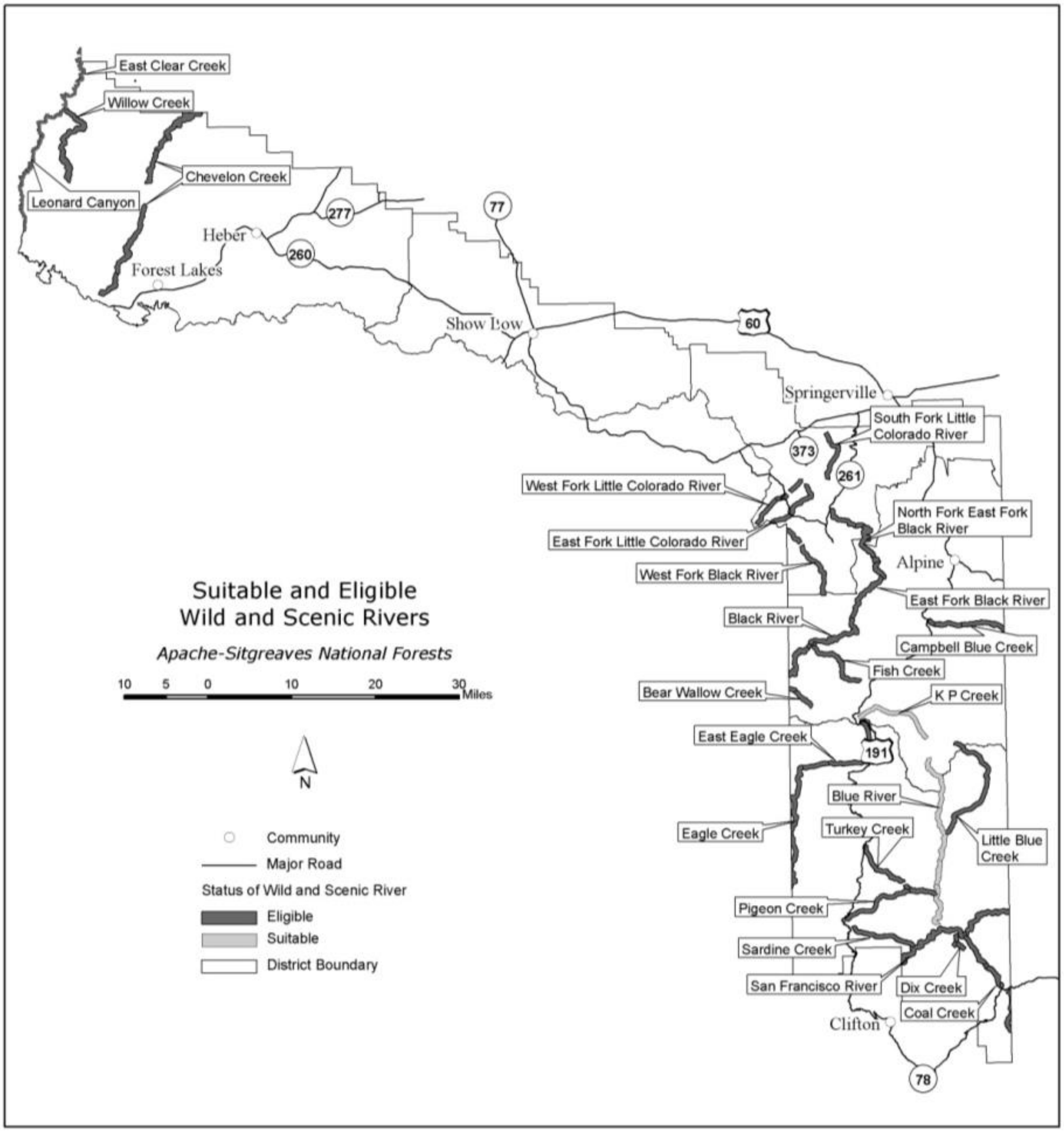

Figure 55. Map of suitable and eligible wild and scenic rivers on the Apache-Sitgreaves NFs

Suitable Rivers

Suitable rivers include portions of the Blue River and KP Creek (table 118). These rivers were found to be suitable for inclusion in the National Wild and Scenic Rivers System through a separate environmental analysis (Forest Service, 2010d). Suitable rivers are managed to maintain their conditions and values until congressional action is taken.

Table 118. Suitable wild and scenic rivers by river classification

River Name	Wild (miles)	Scenic (miles)	Recreational (miles)	Total (miles)
Blue River	23.3	4.2	—	27.5
KP Creek	11.3	—	—	11.3
Total miles	**34.6**	**4.2**	**0.0**	**38.8**

River Corridors and Management Areas

A river corridor includes all NFS lands within one-quarter mile of each side of the eligible or suitable river. On the Apache-Sitgreaves NFs, there are 97,215 acres of eligible or suitable river corridors. These river corridors are found in most management areas across the forests; they do not occur in Developed Recreation Sites, Escudilla Demonstration Area, and Escudilla Wilderness Management Areas.

Portions of the eligible West Fork and East Fork Little Colorado Rivers are located within Mount Baldy Wilderness Management Area. All of the eligible Bear Wallow Creek is within Bear Wallow Wilderness Management Area. There are no eligible or suitable rivers in Escudilla Wilderness Management Area. A portion of the suitable Blue River and most of KP Creek are within the Blue Range Primitive Area and Additions Management Area.

Environmental Consequences of Alternatives

Eligible and suitable river segments and their corridors would be managed to maintain the outstanding values and qualities that made them eligible or suitable for designation in **all alternatives** in accordance with Forest Service Handbook 1909.12, Chapter 82.5 **-** Interim Management of Eligible or Suitable Rivers. The presence of these river corridors may act to increase public interest and awareness of river resources, especially in the generally arid Southwest. Also, as populations increase and more people visit the Apache-Sitgreaves NFs, the value of managing these areas in their relatively natural condition would increase.

Effects of Eligibility, Suitability, and Classification

The presence of an eligible or suitable river constrains the type and manner of projects and activities that may be conducted within the river corridor. Three constraints apply to activities in all eligible and suitable river corridors: (1) the protection of the free flowing river character, (2) the protection of the identified outstandingly remarkable values, and (3) the maintenance of the river classification (wild, scenic, or recreational) unless a completed suitability study recommends a less restrictive classification. The overall effect of these constraints is to protect, maintain, and possibly enhance the values for which the river segments were found eligible or suitable.

Application of the management guidelines[33] found in Forest Service Handbook 1909.12, Chapter 82.5 - Interim Management of Eligible or Suitable Rivers could also constrain the management of other resources within the river corridor, thereby minimizing the effects of activities on the outstandingly remarkable values. These guidelines vary by river classification with the most restrictions on wild river corridors and the least on recreational river corridors. Although some activities may be limited or restricted, river characteristics and outstandingly remarkable values would be maintained, protected, and potentially enhanced.

For example, a proposed mechanical vegetation treatment in a wild river corridor would not be allowed, but a proposed prescribed burn in the same area could be allowed as long as the identified outstandingly remarkable values are protected. The effects of mechanical vegetation treatments and prescribed burning are described in other sections throughout the FEIS.

Effects of Management Activities

Under **all alternatives**, management activities outside the eligible and suitable river corridors should not affect the outstandingly remarkable values because projects and activities would be subject to standards, guidelines, and best management practices (BMPs).

Effects of Management Areas

Eligible and suitable river corridors overlay a number of management areas across the alternatives. Because the interim management guidelines by wild and scenic river classification do not always match the management area direction, river corridors are managed by the more restrictive management area or river corridor direction, especially with regard to identified outstandingly remarkable values. The least restrictive management areas are Forest Land Management Area in **alternative A** and General Forest Management Area in the **action alternatives;** while Wilderness is the most restrictive management area in **all alternatives**. Table 119 and table 120 summarize the river corridor acreages by alternative, management area, and wild and scenic river classification (more detailed information can be found in the "Wild and Scenic Rivers Specialist Report," Forest Service, 2014w) **Alternative A** management areas generally do not correspond to the management areas in the **action alternatives**.

There is a general rule that the more restrictive management applies when there is a difference between wild and scenic river management and the management area(s) over which a river corridor lays. The location of a river corridor may affect its management if the management area it overlays has more restrictive management. Because some management areas change by alternative, a river corridor in the Natural Landscape Management Area in one alternative could be in the General Forest Management Area in another.

For example, under **alternative D**, 21,040 acres of scenic and recreational river corridors would be managed under the more restrictive Recommended Wilderness Management Area. Recommended wilderness management of scenic and recreational rivers areas would provide greater protection to the river characteristics and outstandingly remarkable values through unsuitability for motorized vehicle use, unsuitability for timber production, and very high scenic

[33] These guidelines are specific to water resources projects, hydroelectric power, minerals, transportation system, utility proposals, recreation development, motorized travel, wildlife and fish projects, vegetation management, and domestic livestock grazing.

integrity. This would restrict some activities that are allowable in scenic or recreational river corridors (e.g., construction of new roads, mechanical vegetation management). Conversely, a wild river located in the General Forest Management Area in the **action alternatives** (e.g., Segment 2 of West Fork Black River) would be managed according to wild river guidance, not General Forest Management Area direction.

Regardless of which management area eligible and suitable rivers overlay, the river characteristics and outstandingly remarkable values would be protected through application of the interim management guidelines. For example, approximately two-thirds of the Apache-Sitgreaves NFs eligible and suitable rivers with fish populations and/or habitat have these outstandingly remarkable values[34]. Management of wild and scenic rivers would provide additional protection for the fish populations and habitat. For example, construction of a dam on any river classification would be prohibited, which would maintain the fish habitat. Also as discussed above, a recreational or scenic river classification would provide greater protection for a fish outstandingly remarkable value when the river corridor overlays a General Forest or Community-Forest Intermix Management Area because of the requirement to protect outstandingly remarkable values.

Table 119. River corridor acres by classification and management area for alternative A

Management Area	Wild	Scenic	Recreational
Forest Land	8,133	6,933	4,707
Woodland	13,895	3,229	10,880
Riparian	4,724	1,189	3,498
Grasslands	1,314	1,390	297
Developed Recreation Sites (not mapped)	0	0	0
Mount Baldy Wilderness	1,283	635	8
Blue Range Primitive Area and Additions	12,344	0	0
Escudilla Demonstration Area	0	0	0
Research Natural Area	5	148	0
Water	2	25	0
Bear Wallow Wilderness	977	0	286
Escudilla Wilderness	0	0	0
Black River (Mainstem)	4,127	174	102
West Fork Black River	4,415	325	1,792
Chevelon Canyon	5,245	1,125	450
East and West Forks Little Colorado River	558	358	209
Sandrock	1,329	1,103	0
Total Acres	**58,351**	**16,634**	**22,229**

[34] Rivers with fish populations and/or habitat outstandingly remarkable value(s): Chevelon Creek, East Fork Little Colorado River, Bear Wallow Creek, Black River, West Fork Black River, East Fork Black River, North Fork East Fork Black River, Fish Creek, Campbell Blue Creek, Blue River, KP Creek, San Francisco River, Coal Creek, Dix Creek, Eagle Creek, and East Eagle Creek.

Table 120. River corridor acres by wild and scenic river classification and management area for the action alternatives (alternatives B, C, and D)

Management Area[a]	Wild			Scenic			Recreational		
	Alt. B	Alt. C	Alt. D	Alt. B	Alt. C	Alt. D	Alt. B	Alt. C	Alt. D
General Forest	13,360	37,091	7,887	8,056	14,920	5,612	8,579	20,488	8,409
Community-Forest Intermix	37	37	37	0	0	0	0	0	0
High Use Developed Recreation Area	124	124	124	0	0	0	0	0	0
Energy Corridor	0	0	0	38	38	38	0	0	0
Wildlife Quiet Area	492	492	795	0	0	421	17	17	17
Natural Landscape	27,466	3,735	118	6,864	0	46	13,294	1,387	1,417
Recommended Research Natural Area	2,268	2,268	1,675	886	886	747	43	43	32
Research Natural Area	0	0	0	155	155	155	0	0	0
Recommended Wilderness	0	0	33,111	0	0	8,981	2	0	12,059
Primitive Area	12,344	12,344	12,344	0	0	0	0	0	0
Wilderness	2,260	2,260	2,260	635	635	635	294	294	294
Total Acres[b]	**58,351**	**58,351**	**58,351**	**16,634**	**16,634**	**16,635**	**22,229**	**22,229**	**22,228**

[a] Wild Horse Territory is not listed because there are no wild and scenic rivers in the management area.

[b] Minor acre differences are due to rounding.

Cumulative Environmental Consequences

The area for this analysis includes the watersheds of eligible and suitable rivers on adjacent national forests (Gila and Coconino NFs). This discussion is pertinent to **all alternatives**. There would be no cumulative environmental consequences to the suitable rivers on the Apache-Sitgreaves NFs because they arise and are completely within the forests boundary. Most of the eligible rivers arise and are completely within the forests boundary. There would be beneficial cumulative effects to Leonard Canyon and East Clear Creek because the river corridors on the Coconino NF would be managed to maintain the free flowing river character and to protect the outstandingly remarkable values. This would also be the case for the Campbell Blue Creek and Coal Creek river corridors on the Gila NF.

The San Francisco River arises on the Apache-Sitgreaves NFs west of Alpine, AZ, but flows through the Gila NF and private lands before reentering the Apache-Sitgreaves NFs. The upper San Francisco River from its headwaters through the Gila NF is not an eligible or suitable wild and scenic river. Only one San Francisco River tributary, Whitewater Creek, on the Gila NF is an eligible wild and scenic river. There could be negative cumulative environmental consequences to the downstream eligible San Francisco River segment from vegetation treatments, wildland fire activities, and livestock grazing upstream on the Gila NF, but their extent is not known and they are not quantifiable. However, as with activities proposed for the Apache-Sitgreaves NFs, activities on the Gila NF would be subject to standards, guidelines, and BMPs. The greatest potential for negative consequences to the eligible San Francisco River would be from unplanned events that could affect the fish species and wildlife species and habitat outstandingly remarkable values (e.g., increased sedimentation, post-fire flooding).

Inventoried Roadless Areas

Inventoried roadless areas (IRAs) are a Forest Service administrative designation. The full analysis for IRAs can be found in the “Wilderness Resources and Inventoried Roadless Areas Specialist Report” (Forest Service, 2014x) available in the “Plan Set of Documents.”

There are nine roadless area characteristics identified in the 2001 Roadless Area Conservation Rule (RACR). Roadless area characteristics are resources or features that are often present in or characterize roadless areas:

- High quality or undisturbed soil, water, and air;
- Sources of public drinking water;
- Diversity of plant and animal communities;
- Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land;
- Primitive, semi-primitive nonmotorized, and semi-primitive motorized classes of dispersed recreation;
- Reference landscapes;
- Natural appearing landscapes with high scenic quality;
- Traditional cultural properties and sacred sites; and
- Other locally identified unique characteristics.

The roadless area characteristics are used to evaluate the effects of the alternatives to the IRAs. An IRA may or may not have all characteristics.

In the analysis for this resource, assumptions and policies used include the following:

- Activities in IRAs under alternatives A, B, and D would be consistent with the 2001 RACR to maintain their roadless characteristics.
- During the plan revision process, there were two conflicting legal decisions concerning the status of IRAs. Because there was no resolution of the conflicting rulings at the time this analysis was initiated, the Forest Service included consideration of no IRAs and no IRA management in alternative C in response to public comments that requested full multiple-use of Apache-Sitgreaves NFs IRA lands. NEPA does allow the consideration of alternatives that may not be legal but address public concerns (40 CFR 1502.14(c)). During the analysis process, the roadless area conservation rule was upheld in federal court and alternative methods of IRA management, such as those considered in alternative C cannot be selected in the record of decision for the EIS.
- IRA lands that were affected by the 2011 Wallow Fire retain their roadless character.

Affected Environment

There are 17 IRAs on the Apache-Sitgreaves NFs (figure 56, figure 57, and table 121). These areas total approximately 322,000 acres. In general, these lands include rough, broken terrain with steep-sided canyons and are located in low population areas. The forests' IRAs are the result of Forest Service rulemaking and environmental analysis (Forest Service, 2000) that was conducted in the late 1990s and early 2000s. IRAs are not a management area, but they overlay a variety of management areas.

The vegetation and other resources in the Bear Wallow, Salt House, Black River Canyon, Centerfire, Campbell Blue, Mother Hubbard, and Escudilla Mountain IRAs were affected by the 2011 Wallow Fire. However, the IRAs retain their roadless character.

Table 121. Inventoried roadless areas (IRAs)

Inventoried Roadless Area	Acres	Ranger District
Leonard Canyon	3,069	Black Mesa
Chevelon Canyon	5,569	Black Mesa
Escudilla Mountain[a]	885	Alpine
Mother Hubbard[b]	2,177	Alpine
Campbell Blue	7,003	Alpine
Nolan[b]	6,780	Alpine
Centerfire	13,130	Alpine
Bear Wallow[a]	878	Alpine
Black River Canyon	11,813	Alpine
Hot Air	31,703	Clifton
Salt House[a]	21,842	Clifton
Painted Bluffs	43,105	Clifton
Lower San Francisco	59,308	Clifton
Pipestem	34,592	Clifton
Hells Hole[b]	15,512	Clifton
Mitchell Peak	35,392	Clifton
Sunset	28,946	Clifton
Pipestem/Lower San Francisco	152	Clifton
Total Acres	**321,856**	

[a] Only IRA acres outside designated wilderness are listed. IRA acres in Bear Wallow, Escudilla Mountain, and Salt House IRAs that were designated as wilderness in 1984 are not shown.

[b] Adjacent IRA lands are found on the Gila NF in New Mexico. Only Apache-Sitgreaves NFs acres are shown.

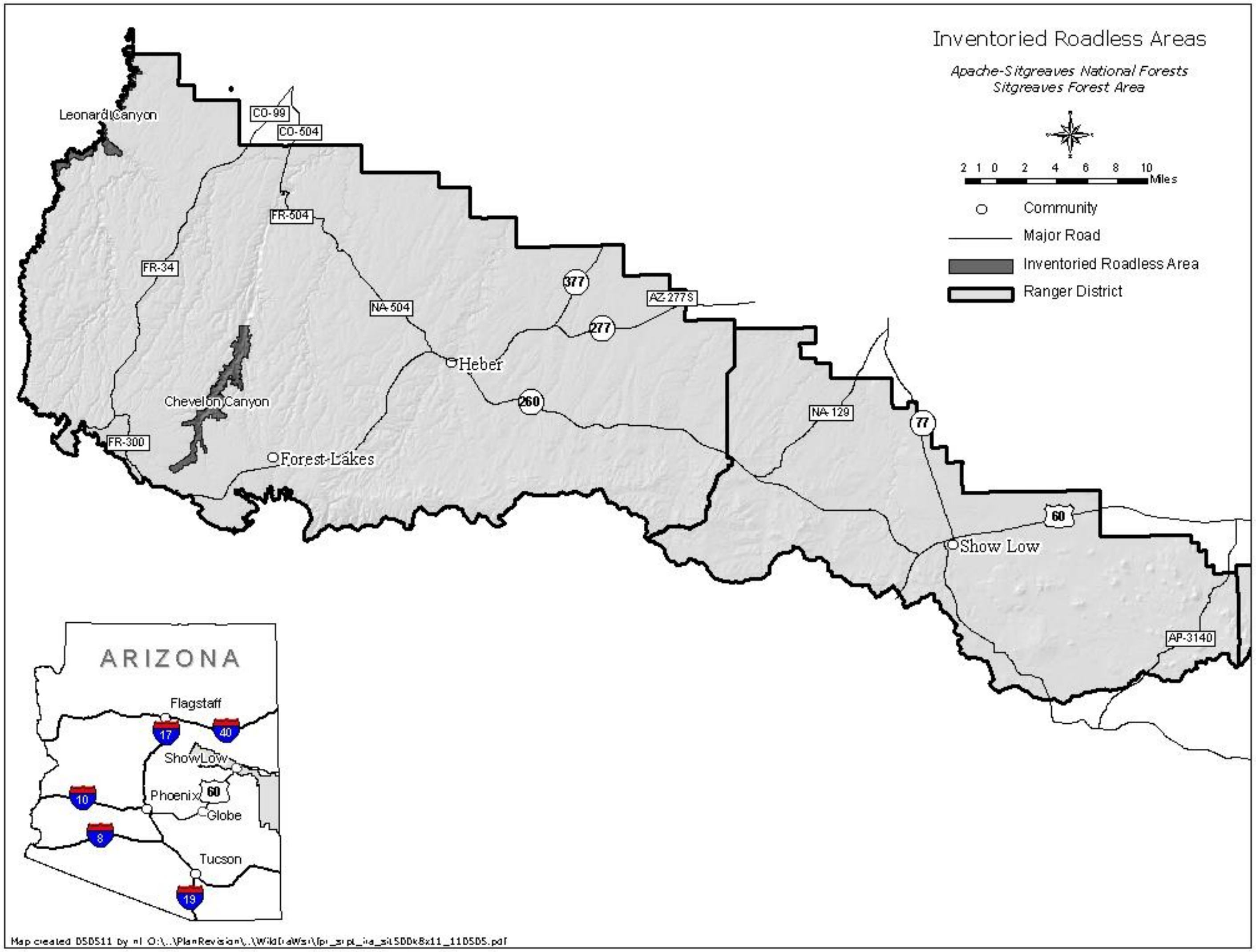

Figure 56. Map of inventoried roadless areas (IRAs) – Sitgreaves NF

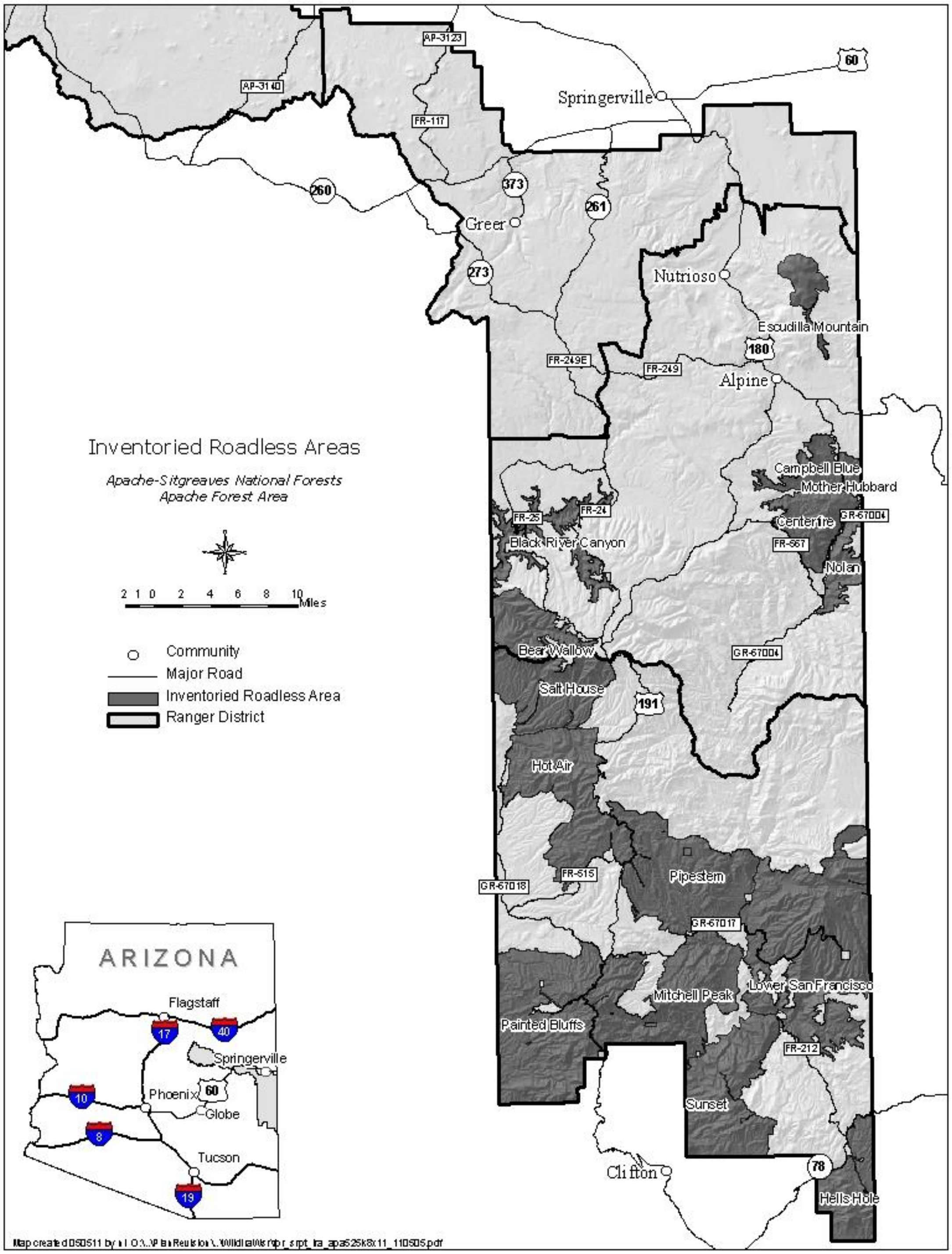

Figure 57. Map of inventoried roadless areas IRAs – Apache NF

Roadless areas were identified during the 1979 RARE II process, an extensive inventory of NFS lands areas. On the Apache-Sitgreaves NFs, the Arizona Wilderness Act of 1984 designated most, but not all, of the Escudilla Mountain and Bear Wallow IRAs as wilderness. The remaining roadless lands were released to multiple-use management until revision of the land management plan, at which time they would be reevaluated for wilderness potential.

Because there were no roadless areas during development of the 1987 plan, there are no specific goals or objectives relating to them. Between 1985 and 2000, numerous surface disturbing and vegetation removal activities occurred on Apache-Sitgreaves NFs lands that had previously been identified as roadless. When the roadless lands were reconsidered in the 2000 Roadless Area Conservation FEIS, there was no adjustment of boundaries to reflect these activities. At this time, the Apache-Sitgreaves NFs are unable to adjust IRA boundaries to remove those portions which no longer have roadless characteristics.

Environmental Consequences of Alternatives

There would be no changes to the roadless character of IRAs in **alternatives A, B, and D**. IRAs would be managed under the 2001 RACR and plan direction (primarily the Natural Landscape Management Area), which would maintain the roadless characteristics, if present.

Alternative C would consider forest management without IRAs. Most of these lands would be part of the General Forest (286,590 acres) and Energy Corridor (40 acres) Management Areas. Management activities, including timber harvest, other mechanical vegetation treatments, and road construction and reconstruction, could occur in these areas which could affect their roadless characteristics. Because of the terrain in these areas, timber harvest and road construction are not anticipated, but the following consequences to roadless characteristics could happen should management activities occur.

The remainder of the non-IRA lands in **alternative C** would be in the Natural Landscape (31,813 acres), Recommended Wilderness (885 acres), and Recommended Research Natural Area (1,968 acres) Management Areas. Management area direction for these 34,666 acres would maintain the roadless characteristics, if present.

In some cases the presence of eligible and suitable river corridors across these lands could provide some protection of roadless characteristics. For example, a wild river corridor would continue to provide primitive recreation opportunities, maintain high to very high scenic integrity, and protect threatened, endangered, proposed, candidate, and sensitive species habitats. Also the presence of a river corridor may restrict some activities (see the “Eligible and Suitable Wild and Scenic Rivers” section) that could affect roadless characteristics.

Soil/Watersheds/Air

Under **alternative C**, there could be greater effects to air, soil, and watershed resources (as described in the “Air,” “Soil,” and “Watershed” sections) because this alternative proposes the highest amounts of mechanical vegetation treatments and associated road use and emphasizes motorized recreation. Improvement of watershed conditions in these areas would be limited because they do not occur near communities or contain harvestable timber. Dust from mechanical treatments and recreation activities would potentially be greatest. **Alternative C** poses the most risk of soil compaction and ground cover removal.

Public Drinking Water

There are no municipal watersheds on the Apache-Sitgreaves NFs. However, rivers on the forests contribute to water supplies for the metropolitan areas in southern Arizona. Effects to these rivers are described above. **Alternative C** would have the greatest potential for increasing sediment from roads because of the higher proportion of mechanical treatments/harvest as well as an emphasis on motorized recreation opportunities (see the “Water Resources” section).

Diversity of Plant and Animal Communities

Alternative C would have the greatest potential to fragment ecosystems, including wildlife habitats, and to introduce and spread nonnative invasive species from road construction, road reconstruction, and timber harvesting activities. As human-caused fragmentation increases, the amount of core wildlife habitat decreases. Habitat fragmentation also decreases habitat connectivity and affects wildlife movement, isolating some species and increasing the risk of local extirpations or extinctions (see the “Wildlife and Rare Plants” section).

Threatened, Endangered, Proposed, Candidate, and Sensitive Species Habitats and Species Dependent on Large, Undisturbed Areas of Land

Threatened, endangered, proposed, candidate, and sensitive species habitats in **all alternatives** would be managed according to Endangered Species Act and Regional Forester direction (see the “Wildlife Specialist Report - Viability,” (Forest Service, 2014bb) and “Fisheries Specialist Report” (Forest Service, 2014g).

Primitive and Semi-primitive Recreation Opportunities

IRAs under **alternatives A, B, and D** would be managed for primitive and semi-primitive recreation opportunities, except where adjacent to roads open to highway legal vehicles (roaded natural recreation opportunities). Under **alternative C** the lands would be managed for wider variety of recreation opportunities (see the “Recreation” section). Roaded natural and semi-primitive motorized recreation opportunities could increase, while primitive and semi-primitive nonmotorized recreation opportunities could decrease.

Reference Landscapes

Three recommended research natural areas (RNAs) in **alternative C** that could serve as reference landscapes all or partially overlap the non-IRA lands. These recommended RNAs would be protected and maintained in a natural condition for the purpose of conducting non-manipulative research and for fostering education. They would be managed for nonmotorized access (see the “Research Natural Area” section). So, these reference landscapes would continue to be protected in **alternative C**.

High Scenic Quality

IRAs in **alternatives A, B, and D** would be managed for high to very high scenic integrity. Under **alternative C**, these lands would be managed for moderate, high, and very high scenic integrity (see the “Scenic Resources” section). Depending on location, the scenic quality of some of these lands could be reduced by management activities.

Traditional Cultural Properties/Sacred Sites

Protection of traditional cultural properties (TCPs) and sacred sites would continue under **alternative C** through the elimination of cross-country motorized travel. Further protection would continue with the suitability determinations for some lands special uses and motorized uses found in chapter 4 of the proposed plan (see the “American Indian Rights and Interests” section).

Local Unique Characteristics

No local unique characteristics have been identified for the IRAs.

Cumulative Environmental Consequences

The cumulative effects analysis area includes the adjoining federally managed lands, including the Coconino and Gila NFs. There would be no cumulative environmental consequences under **all alternatives** because the roadless characteristics of the IRAs would be maintained by terrain and limited timber harvest potential.

Wilderness Resources

Wilderness resources include designated wilderness, the Blue Range Primitive Area and presidential additions, and recommended wilderness. The full analysis for wilderness resources can be found in the “Wilderness Resources and Inventoried Roadless Areas Specialist Report” (Forest Service, 2014x) available in the “Plan Set of Documents.”

The presence of each of the above areas, along with the existing condition, is analyzed. The only wilderness resource that changes by alternative is recommended wilderness. Therefore, the majority of analysis is directed toward the programmatic environmental consequences of the Recommended Wilderness Management Area.

In the analysis for this resource, assumptions and policies used include the following:

- All designated wilderness is managed according to the Wilderness Act, 36 CFR § 293, applicable Forest Service manuals and handbooks, and the land management plan.
- The entire Blue Range Primitive Area (including the Blue Road corridor) and the 1971 presidential additions to the primitive area are managed according to 36 CFR § 293.17, applicable Forest Service manuals and handbooks, and the land management plan.
- The Hells Hole, Nolan, and Mother Hubbard potential wilderness areas (a total of 26,023 acres) would be managed to protect their wilderness characteristics until a decision is made in the revised Gila NF land management plan as to whether or not to recommend these areas for wilderness designation. They are included in the Natural Landscape Management Area in alternatives B, C, and D.
- Livestock management in the wilderness and primitive areas is in conformance with the Congressional Grazing Guidelines (Forest Service Manual 2320 - Wilderness Management. 2323.22 - Exhibit 01, Congressional Grazing Guidelines).
- Any area that is recommended for wilderness (Recommended Wilderness Management Area) through the planning process is a preliminary administrative recommendation that would receive further review, including applicable NEPA analysis, and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the

President of the United States. Congress has reserved the authority to make final decisions on wilderness designation.

- Designated wilderness, the Blue Range Primitive Area and presidential additions, and potential wilderness that were affected by the 2011 Wallow Fire retain their wilderness character.

Affected Environment

Designated Wilderness

The Apache-Sitgreaves NFs include three designated wilderness areas: Mount Baldy, Escudilla, and Bear Wallow (table 122 and figure 58), totaling 23,233 acres. Wilderness areas are managed according to the Wilderness Act of 1964, which protects their wilderness values. Wilderness areas provide outstanding opportunities for solitude or a primitive and unconfined type of recreation. They also provide wildlife habitat and a variety of natural resource and social values. Motorized equipment and mechanical transport are prohibited in wilderness. Livestock grazing is allowed in wilderness areas, unless specifically excluded by the law designating the area. The laws listed below do not restrict grazing in any of the Apache-Sitgreaves NFs wilderness areas.

Table 122. Apache-Sitgreaves NFs wilderness areas

Wilderness	Designated	Law No.	Acres	Ranger District
Mount Baldy	1970	PL 91-504	6,842	Springerville
Escudilla	1984	PL 98-406	5,157	Alpine
Bear Wallow	1984	PL 98-406	11,234	Alpine

Mount Baldy Wilderness

Mount Baldy Wilderness was designated as part of the National Wilderness Preservation System in 1970. It lies on the eastern slope of Mount Baldy. Elevations range from 9,000 feet to 11,400 feet above sea level. Mount Baldy is an extinct volcano and has experienced three distinct periods of glaciation. The peak’s summit is on the Fort Apache Indian Reservation.

There are three developed trails, totaling 18 miles, in Mount Baldy Wilderness. This trail system is heavily used by day hikers from mid-May through late September, with the heaviest use on weekends and holidays. Trail encounters with other hikers and equestrians are common. Annual trail maintenance consists of removing fallen trees and cutting brush. Two trailheads provide access to Mount Baldy Wilderness.

The majority of Mount Baldy Wilderness is spruce-fir forest with blue spruce, Engelmann spruce, white fir, and corkbark fir. The remaining forested areas are wet mixed conifer and dry mixed conifer forests, including the above species, Douglas-fir, Southwestern white pine, and ponderosa pine. A defoliator (e.g., loopers, spruce aphids) infestation has killed a portion of the spruce forest. Tree composition varies with elevation, but Douglas-fir and blue spruce are the principal species. Aspen is interspersed throughout the forests. The remainder of the area is montane/subalpine grasslands and wetland/cienega riparian areas along the upper Little Colorado River drainages. The East and West Forks of the Little Colorado River are perennial through this wilderness and provide habitat for the threatened Apache trout. The wilderness boundary is defined by the forests' boundary with the Fort Apache Indian Reservation and partially by fences on the east.

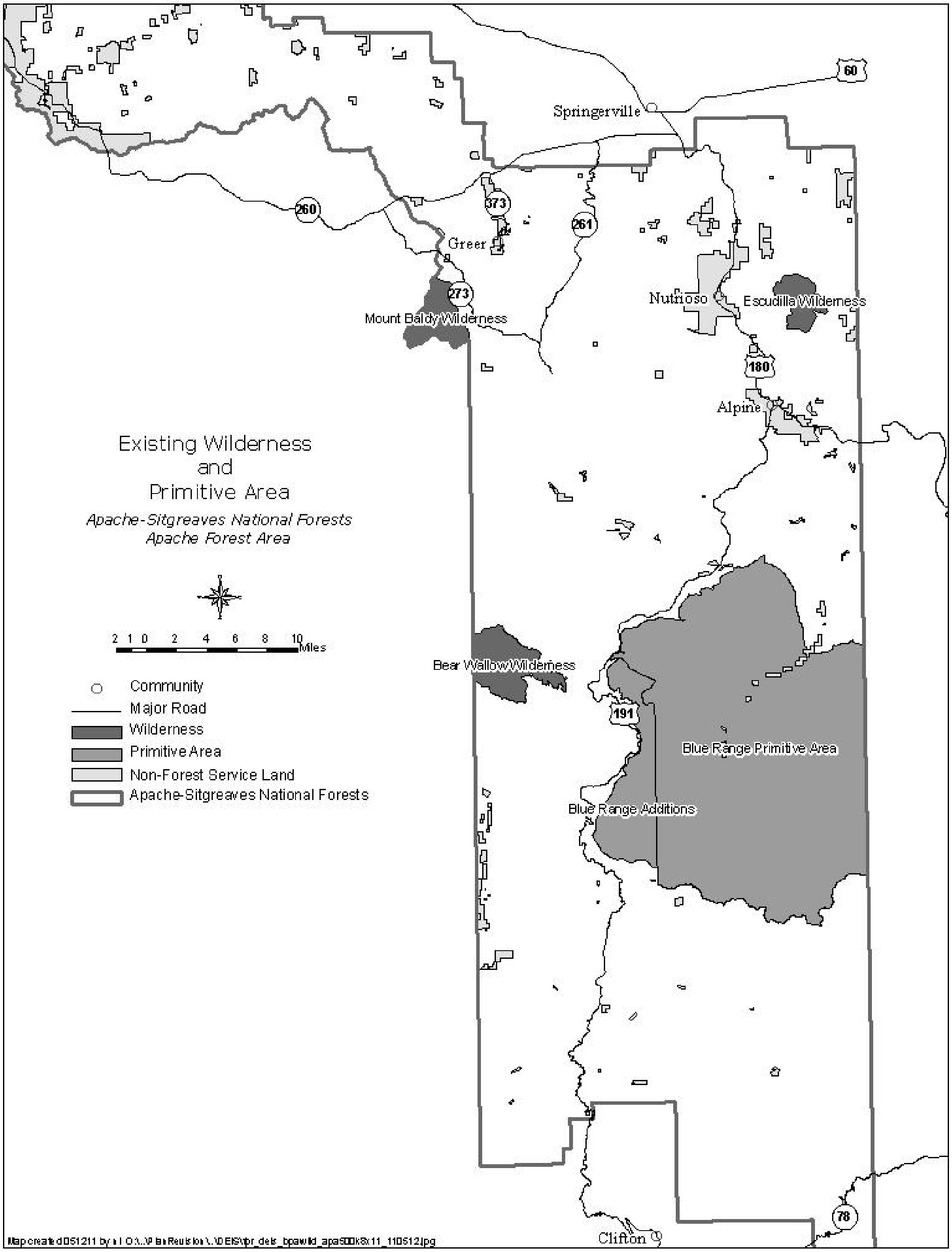

Figure 58. Map of existing wilderness and primitive areas on the Apache-Sitgreaves NFs

Escudilla Wilderness

Escudilla Wilderness encompasses the top and sides of Escudilla Mountain. It includes several high elevation meadows that contain relatively rare plant associations. Potential natural vegetation types (PNVTs) in the wilderness include spruce-fir forest, wet mixed conifer forest, montane/subalpine grasslands, wetland/cienega riparian areas, and ponderosa pine forest. In addition, there is a large aspen component on Escudilla Mountain. The vegetation, trails, and other resources in Escudilla Wilderness were affected by the 2011 Wallow Fire. However, the area retains its wilderness character.

Notable landmarks in or just outside the wilderness include Profanity Ridge, Terry Flat, Toolbox Draw, and the Punchbowl. There are two trails, totaling about 6 miles, in this wilderness. The main trail (Escudilla National Recreation Trail) receives heavy day use during the summer and fall. Government Trail connects with the main trail part way to the top but starts at a different trailhead and receives less use. The wilderness boundary is generally not discernible on the ground because it occurs at mid-slope on the mountain.

Bear Wallow Wilderness

Bear Wallow Wilderness is known for its canyon, large old conifers, and fall aspen colors. Bear Wallow Creek is perennial, providing habitat for the threatened Apache trout. Wildlife is abundant throughout the area. There are five trails, totaling 20 miles, in Bear Wallow Wilderness that provide access into and within this area. There are four trailheads, three along the north boundary and one on the south. The wilderness boundary is generally defined by roads and the forests' boundary. The vegetation, trails, and other resources in Bear Wallow Wilderness were affected by the 2011 Wallow Fire. However, the area retains its wilderness character.

PNVTs in Bear Wallow Wilderness include wet mixed conifer forest, ponderosa pine forest, Madrean pine-oak woodland, dry mixed conifer forest, spruce-fir forest, montane willow riparian forest, and wetland/cienega riparian areas.

Wilderness Uses

The 2002 National Visitor Use Monitoring program estimated 32,000 visits to the three wilderness areas (Forest Service, 2006). Of those visitors, 81 percent were male, 19 percent were female, 92 percent were white, and more than 63 percent were between 31 and 60 years of age. Most wilderness visitors were from the southern Arizona metropolitan areas (Phoenix and Tucson) or the local area. The average length of stay was 4.6 hours, indicative of the high amount of day-use the areas receive. Less than 1 percent of those interviewed used the services of a commercial guide (Kocis et al., 2002).

Wilderness visitors felt there were few people there. Overall, wilderness visitors were satisfied with their visit to the Apache-Sitgreaves NFs. The only categories, possibly related to the wilderness experience, where visitor satisfaction could be improved were condition of the natural environment and signing adequacy. It is not known if these concerns were specifically for the wilderness areas or for the forests in general.

There is no permit system in place for managing visitor access to the wilderness areas. However, Mount Baldy Wilderness has group size limits of 6 people per party for overnight camping and 12 people per party for day-use hiking and horseback riding. These group size limits were set to maintain the desired condition of opportunities for solitude and semi-primitive recreation. Maximum group size limits for Escudilla and Bear Wallow Wilderness areas are 25 people and/or 35 horses. The 1987 plan does not allow pack stock grazing in wilderness.

An inventory of wilderness campsites and noxious weeds was conducted in 2012. Twenty-three campsites and one patch of noxious weeds were found in Mount Baldy Wilderness. Almost all of these campsites are along the two main trails, East Baldy and West Baldy. A small patch of musk thistle was found near West Baldy Trail. No campsites or noxious weeds were found in Escudilla Wilderness. Twenty-three campsites and no noxious weeds were found in Bear Wallow Wilderness. Almost all of these campsites are along Bear Wallow Creek.

Authorized livestock grazing has not occurred recently in any of the Apache-Sitgreaves NFs' wilderness areas. Livestock grazing in Mount Baldy Wilderness has not occurred since 1992, when an agreement between the Forest Service and the livestock permittee was implemented to avoid listing of the Arizona willow under the Endangered Species Act of 1973. The Greer Allotment Management Plan (AMP) decision (dated March 23, 1999) removed grazing from Mount Baldy Wilderness. Removal was based on Arizona willow protection, limited forage availability, and conflicts with recreation and riparian resource values. The South Escudilla AMP decision (dated February 13, 2001) removed grazing from Escudilla Wilderness. Removal was based on limited forage and water availability, dense timber, conflicts with recreation users, presence of wild ungulates and predators, and limited access and ability to manage and gather livestock. The KP Summer Pasture, which includes Bear Wallow Wilderness, was waived back to the Forest Service in November 2001. The limited amount of forage has not been reallocated.

Wilderness Management Concerns

All three wilderness areas have motorized and mechanized vehicle trespass issues. The greatest problems occur in Mount Baldy Wilderness. Even though Mount Baldy Wilderness boundaries are signed and fenced, motorized vehicle trespass often occurs along the southeast boundary from the Burro Mountain area, snowmobiles trespass along the eastern boundary during the winter, and mountain bikes and ATV tracks are occasionally found on the trails. Occasionally, ATVs and mountain bikes trespass in Escudilla Wilderness. ATVs regularly trespass into Bear Wallow Wilderness from Rose Spring Trailhead.

The Fort Apache Indian Reservation abuts Mount Baldy Wilderness on its northwest, southwest, and south boundaries. These adjacent reservation lands are closed to all public entry. This often causes confusion and conflict because Baldy Peak, the highest point, is on reservation lands and only a very small portion of Mount Baldy, the ridge that includes Baldy Peak, is on the Apache-Sitgreaves NFs. The Apache-Sitgreaves NFs/reservation boundary is poorly signed so many travelers do not recognize the boundary. One-quarter mile of East Baldy Trail, near the Mount Baldy summit, was relocated to discourage hikers and equestrians from continuing onto the reservation.

Livestock from the reservation trespass into Mount Baldy Wilderness annually and often remain there until they return home on their own.

Blue Range Primitive Area and Presidential Additions

The Blue Range Primitive Area (179,153 acres) is the only remaining primitive area in the National Forest System and is located on the Alpine and Clifton Ranger Districts (figure 57). It was administratively designated by the Forest Service (L-20 regulations) as a primitive area on June 21, 1933, to preserve its wilderness qualities.

In 1971, the Forest Service submitted a recommendation to the President of the United States for the Blue Range Wilderness in Arizona and New Mexico. The President forwarded the recommendation to Congress, who eventually acted on a portion of the recommendation. In 1980, Congress designated, and the President signed into law (P.L. 96-550), the Blue Range Wilderness in New Mexico. The Arizona portion of the 1971 presidential recommendation included 20,031 acres outside and along the west primitive area boundary (total of 166,591 acres). Congress has not acted on the Forest Service and presidential recommendation for the Blue Range Wilderness in Arizona, and the 1971 recommendation remains in place. The 1987 plan recognizes this in Management Area 8, Blue Range Primitive Area and Additions.

The entire Blue Range Primitive Area and the presidential recommendation additions (199,505 acres) have been managed to protect their wilderness characteristics. The area is managed like wilderness, except that it is open to mineral prospecting and mineral development (Forest Service Manual 2320.3(11)). The Blue Range Primitive Area, including the portions that were excluded from the 1971 presidential recommendation (32,911 acres), was reevaluated as part of the potential wilderness evaluation process and was found to have wilderness characteristics (Potential Wilderness Evaluation Reports PW-03-01-068 and PW-03-01-069).

The Blue Range Primitive Area includes deep, rugged canyons separated by steep, timbered ridges. The Mogollon Rim bisects the area and provides dramatic topographic features. Elevations range from 4,500 feet in the southern portion to 9,100 feet along the rim. This rapid change in elevation results in interesting and unique ecological associations. Unusual and spectacular rock formations highlight the scenery.

The wide variety of PNVTs reflects the area’s topography. PNVTs include Madrean pine-oak woodland, ponderosa pine forest, wet mixed conifer forest, spruce-fir forest, ponderosa pine forest, dry mixed conifer forest, interior chaparral, semi-desert grassland, mixed broadleaf deciduous riparian forest, piñon-juniper woodland, cottonwood-willow riparian forest, and wetland/cienega riparian areas. Fire has been allowed to play a natural role in the primitive area ecosystem. In the last 20 years, approximately 40 percent of the Blue Range Primitive Area has burned in wildfires. The vegetation, trails, and other resources in approximately one quarter of the Blue Range Primitive Area were affected by the 2011 Wallow Fire. However, the area retains its wilderness character.

The area is important in the distribution of wildlife species. It lies on both north-south and east-west migration corridors. Numerous threatened, endangered, candidate, and Regional Forester designated sensitive species are found in the area.

There are approximately 290 miles of nonmotorized trails throughout the area; this number has not changed since 1984. Presently, some trails may not be passable because their maintenance has been deferred or they have been damaged by wildfire or flooding. In some locations, especially in the Hannagan Meadow area, increased visitor use has created a need for more trail maintenance. Many trails in the Blue Range Primitive Area are located in drainages and along creeks; some resource damage may be occurring in these locations. Access for the Blue River Trail was recently improved with the acquisition of an Arizona Game and Fish Department easement through private property and construction of a new trailhead.

Visitor use in 1984 for the Blue Range Primitive Area was estimated at 7,000 recreation visitor days. Most of this use occurred during the fall hunting seasons. At that time, it was felt that the quality of the wilderness experience was not impaired and user expectations were met. There are no current use figures for the Blue Range, but over the last 10 years, Forest Service personnel have noticed increasing summer use. There is no permit system in place for managing visitor access to the primitive area. However, maximum group size is set at 25 people and/or 35 horses. The 1987 plan does not allow pack stock grazing in wilderness or the primitive area.

Potential Wilderness

Apache-Sitgreaves NFS lands were inventoried, as part of the plan revision process, to determine if any of the lands outside of designated wilderness areas contain wilderness characteristics. Fifty-five areas were initially identified that met the criteria of not containing forest or permanently authorized roads and being at least 5,000 acres or, if less than 5,000 acres, are adjacent to an existing wilderness or primitive area. Each of these areas was assigned an ID number (e.g., PW-03-01-xxx). Next, portions of the areas which had been logged or treated, had developed recreation sites, or included power lines were excluded. In some cases, an area was split by a power line resulting in two areas, each at least 5,000 acres. One of the split areas retained the original ID number and the second was assigned a new ID number. Twelve additional areas were created thusly. Next, the R3 criteria for roaded areas, fingers, and extrusions were applied to exclude areas that do not meet the purpose of considering an area for wilderness potential. If at any time during the inventory process an area was reduced to less than 5,000 acres, it was excluded from further consideration unless it was adjacent to an existing wilderness or primitive area or could be effectively managed as a separate unit; 26 areas were excluded. The ID numbers of these 26 areas were not reassigned to new areas, so they do not appear in table 123. Finally, the inventory areas were screened to determine if they met the statutory definition of wilderness as outlined in Section 2(c) of the Wilderness Act[35]. Seven areas were found to not meet the definition. Thirty-four inventory areas were found to meet the size and lack of roads criteria and the statutory definition of wilderness. Additional information on the inventory process can be found in Forest Service Handbook 1909.12, Chapter 70, Section 71 and the R3 Potential Wilderness Inventory Process document (Forest Service, 2007b). Information on all inventoried areas can be found in the “Plan Set of Documents.”

Next, in-depth evaluations of wilderness capability, availability, and need were completed for the 34 areas. Two additional evaluations were completed for the 1971 Blue Range Wilderness presidential recommendation in Arizona and for the portions of the Blue Range Primitive Area that were not recommended for wilderness, bringing to 36 the total number of areas evaluated. Of these, one entire area (PW-03-01-012) did not meet the capability criteria and was dropped from further consideration. Another area (PW-03-01-069, exclusion 1a) did not meet the capability criteria, so boundary adjustments were made to retain the polygons that did meet the criteria.

[35] An area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable and (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Three areas in the vicinity of Escudilla Mountain were also evaluated because all or portions of the areas are included in the **action alternatives**.

A total of 714,938 acres in 38 areas (table 123, figure 59, and figure 60) were found to have wilderness potential. Additional information on the evaluation process and individual area evaluations can be found in the "Plan Set of Documents" and on the forests' Web site: http://www.fs.usda.gov/asnf/.

Table 123. Areas with wilderness potential

ID Number	Potential Wilderness	Acres	Ranger District
PW-03-01-001	Leonard Canyon[a]	22,406	Black Mesa
PW-03-01-003	West Chevelon Canyon	9,493	Black Mesa
PW-03-01-005	Chevelon Canyon	9,421	Black Mesa
PW-03-01-006	Wildcat Canyon South	6,972	Black Mesa
PW-03-01-011	Black Canyon	4,913	Black Mesa
PW-03-01-021	Mount Baldy Wilderness Addition North	992	Springerville
PW-03-01-022	Mount Baldy Wilderness Addition South	1,031	Springerville
PW-03-01-029	Escudilla Wilderness Addition Northeast	1,161	Alpine
PW-03-01-035	Escudilla Wilderness Addition Southeast	6,039	Alpine
PW-03-01-040	Mother Hubbard	2,656	Alpine
PW-03-01-041	Campbell Blue	9,445	Alpine
PW-03-01-042	Nolan	7,842	Alpine
PW-03-01-043	Blue Range Primitive Area Addition North	4,184	Alpine
PW-03-01-044	Horton-Willow	6,503	Alpine
PW-03-01-046	Black River Canyon East	11,327	Alpine
PW-03-01-047	Black River Canyon West	5,718	Alpine
PW-03-01-049	Hot Air/Salt House	76,129	Clifton/Alpine
PW-03-01-050	Sheep Wash	7,965	Clifton
PW-03-01-051	Painted Bluffs	44,107	Clifton
PW-03-01-052	West Blue/San Francisco[b]	160,016	Clifton/Alpine
PW-03-01-053	Cold Spring Mountain	17,541	Clifton
PW-03-01-054	Hells Hole	15,524	Clifton

ID Number	Potential Wilderness	Acres	Ranger District
PW-03-01-055	Blue Range Primitive Area Addition Southeast	1,255	Clifton
PW-03-01-056	Chevelon Canyon North	6,673	Black Mesa
PW-03-01-057	Coal Creek	5,698	Clifton
PW-03-01-058	Big Lue Mountains	5,222	Clifton
PW-03-01-060	Centerfire[c]	15,269	Alpine
PW-03-01-062	Chevelon Lake	6,585	Black Mesa
PW-03-01-063	Milk Creek	5,387	Alpine
PW-03-01-064	Bear Wallow Wilderness Addition Northwest	172	Alpine
PW-03-01-065	Escudilla Wilderness Addition West	484	Alpine
PW-03-01-066	Bear Wallow Wilderness Addition Southeast	1,207	Alpine
PW-03-01-067	Sunset	30,366	Clifton
PW-03-01-068	BRW Presidential Recommendation	166,393	Alpine/Clifton
PW-03-01-069	BRWPR[d] exclusion 1b	4,504	Alpine
	BRWPR exclusion 2a	1,037	Alpine
	BRWPR exclusion 2b	6,958	Clifton
	BRWPR exclusion 3	4,665	Clifton
	BRWPR exclusion 4	10,404	Clifton
	BRWPR exclusion 5	2,804	Alpine
PW-03-01-070	Escudilla North	377	Alpine
PW-03-01-071	Hulsey	2,926	Alpine
PW-03-01-072	South Escudilla Mountain	5,167	Alpine
Total Acres		**714,938**	

[a] includes 2,981 acres on the Coconino NF

[b] includes 3,577 acres on the Gila NF

[c] includes 30 acres on the Gila NF

[d] Blue Range Wilderness Presidential Recommendation

There is considerable overlap between inventoried roadless areas (IRAs) and areas with wilderness potential. When the forests' lands were inventoried for wilderness potential during the plan revision process, portions of some IRAs were found to not have wilderness characteristics (e.g., naturalness was affected by timber harvesting or road construction) or additional adjacent acreage was found to have wilderness characteristics. So, potential wilderness acres may not be the same as the IRA acres for an area with the same name (i.e., the acreage for Chevelon Canyon IRA (5,569 acres from table 121) is not the same as Chevelon Canyon potential wilderness (9,421 acres from table 123). Also, two or more IRAs may have been included in one potential wilderness.

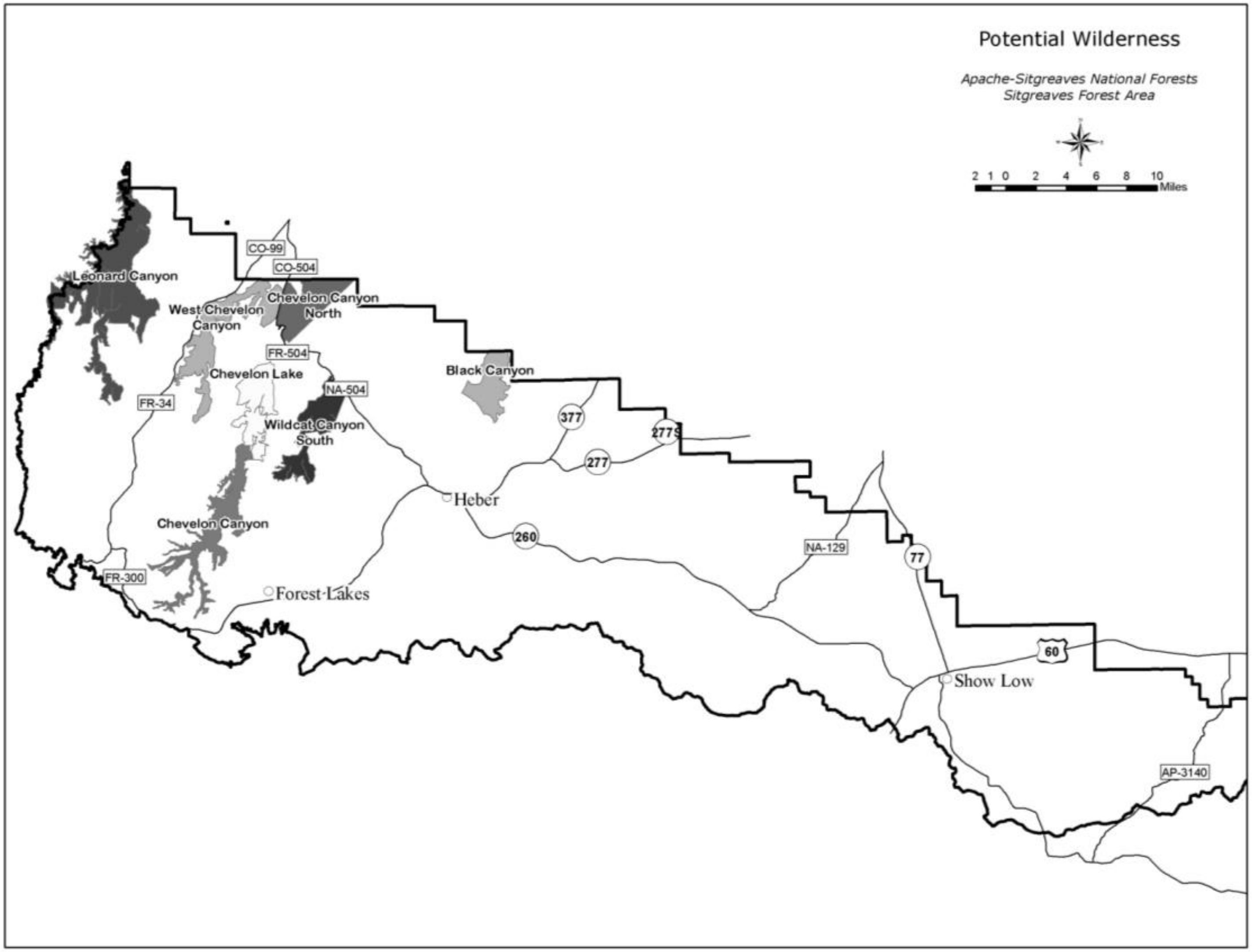

Figure 59. Map of potential wilderness areas – Sitgreaves NF

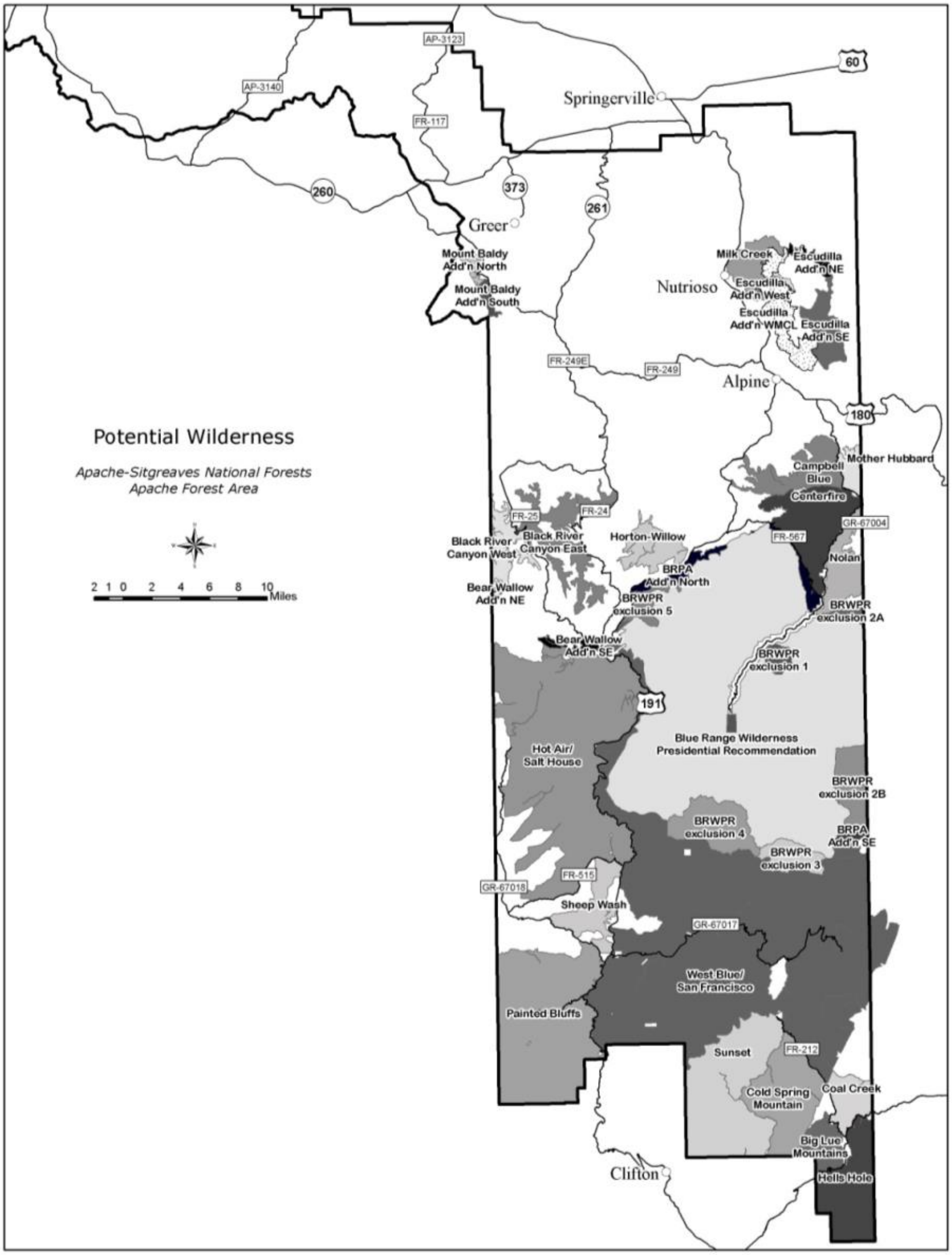

Figure 60. Map of potential wilderness areas – Apache NF

Environmental Consequences of Alternatives

Designated Wilderness

Bear Wallow, Escudilla, and Mount Baldy Wilderness areas would continue to be managed to protect and maintain their wilderness characteristics in **all alternatives**. The development and implementation of wilderness management plans for each area would further protect the areas and could enhance the recreation opportunities of wilderness users. In **all alternatives**, wilderness management concerns (livestock and vehicle trespass and boundary identification) would continue to be addressed at the project-level.

Alternative A would retain the existing group size limits for all wilderness areas as described in the affected environment section. Many existing wilderness campsites are located along streams and in sensitive riparian areas. The current group size limits could result in damage to campsites from even short-term use and are not conducive to providing opportunities for solitude. Also, groups using these areas have been smaller than the current limits.

The **action alternatives** would modify the group size limits for the Escudilla and Bear Wallow Wilderness areas. Group size would be reduced to 12 persons and/or 15 head of stock for hiking and riding groups. These new group size limits are compatible with “Leave No Trace®” principles. The new group size would reduce the potential for resource damage at campsites, in meadows and riparian areas, and along trails and would enhance opportunities for solitude for all wilderness users. The **action alternatives** would keep the current group size limits for Mount Baldy Wilderness.

Blue Range Primitive Area and Presidential Additions

This analysis is limited to the Blue Range Primitive Area and presidential additions. The wilderness recommendations here are in addition to those analyzed in the “Recommended Wilderness” section below.

The entire Blue Range Primitive Area would continue to be managed to protect and maintain its wilderness characteristics in **all alternatives**. **Alternative A** would retain the existing group size limits for the Area. Many existing primitive area campsites are located along streams and in sensitive riparian areas. The current group size limits could result in damage to campsites from even short-term use and are not conducive to providing opportunities for solitude. Also, groups using the Blue Range Primitive Area have been smaller than the current limits.

The **action alternatives** would modify group size limits for the Blue Range Primitive Area. Group size would be reduced to 12 persons and/or 15 head of stock for hiking and riding groups. This new group size limit is compatible with “Leave No Trace®” principles. The new group size would reduce the potential for resource damage at campsites, in meadows and riparian areas, and along trails and would enhance opportunities for solitude for primitive area users.

Alternatives A, B, and C do not recommend the Blue Range Primitive Area for wilderness. There would be no effects, because these lands are managed as primitive area.

The Blue Range Primitive Area wilderness recommendation in **alternative D** (196,868 acres) would be approximately 30,000 acres over the 1971 presidential recommendation. These additional acres within the existing primitive area boundary were reevaluated during the plan revision process and were found to have wilderness characteristics, a reflection of management of these lands as primitive area for the last 40 years. Recommending these additional acres would maintain manageability of the Blue Range Primitive Area and would add eight underrepresented ecosystems to wilderness in the Southwestern Region.

Recommended Wilderness

This analysis does not include the portions of the Blue Range Primitive Area and presidential additions that are recommended for wilderness. They are analyzed separately above.

Any area recommended for wilderness is assigned to the Recommended Wilderness Management Area (see management area maps in appendix J). Mechanized travel would not be allowed in recommended wilderness in **alternatives B** and **C**; however, it would be allowed in **alternative D**. Those lands not recommended for wilderness will be managed according to Forest Service or Apache-Sitgreaves NFs plan guidance for the management area or special area (e.g., RNA, eligible wild and scenic river) in which they occur. Table 124 shows the acreages recommended for wilderness in the four alternatives.

No lands are recommended for wilderness in **alternative A**. It does not contribute to meeting the regional need for additional wilderness near population centers or the addition of underrepresented landforms and ecosystem types in wilderness in the Southwestern Region. Some of the existing boundaries of the Escudilla, Bear Wallow, and Mount Baldy Wilderness areas would continue to be difficult to identify on the ground.

Table 124. Acres recommended for wilderness by alternative[a]

Alt. A (acres)	Alt. B (acres)	Alt. C (acres)	Alt. D (acres)
0	7,074	6,982	491,302[b]

[a] This table does not include the acres of the Blue Range Primitive Area and presidential additions that are recommended for wilderness.

[b] Includes 2,981 acres on the Coconino NF and 3,607 acres on the Gila NF.

Alternative B includes approximately 7,074 acres of Recommended Wilderness Management Area (figure 88 in appendix J) as additions to Escudilla and Bear Wallow Wilderness areas. These additions would improve manageability because the wilderness boundaries would be more identifiable by the public and Forest Service employees. There is some local public support for enlarging Escudilla Wilderness.

Additional areas are not recommended for wilderness under **alternative B** because of the need to use mechanical treatments to restore ecosystems and reduce divergence of the forests' potential natural vegetation types (PNVTs) from desired conditions and to provide forest products for local and regional industry and personal use. Additional wilderness is also not recommended to allow for the mix of recreation opportunities that **alternative B** proposes.

Most of the areas identified as potential wilderness, but not recommended for wilderness, would be managed under Natural Landscape Management Area direction, which would help maintain wilderness characteristics. Areas not in the Natural Landscape Management Area and within inventoried roadless areas would be managed consistent with the 2001 Roadless Area Conservation Rule (RACR), which would help maintain roadless characteristics.

This recommendation could increase the wilderness acreage on the Apache-Sitgreaves NFs and would improve boundary recognition of two wilderness areas. It would contribute to meeting regional needs because the lands contain seven ecosystems that are underrepresented in wilderness in the Southwestern Region. (Information on underrepresented landforms and ecosystems can be found in the “Wilderness Evaluation Reports” in the “Plan Set of Documents.”) **Alternative B** would address some public desire for more wilderness by recommending 7,074 acres for inclusion in the National Wilderness Preservation System.

The potential wilderness areas recommended for wilderness include most of Escudilla Wilderness Additions Southeast and Northwest (6,422 acres), most of Escudilla North (363 acres), a small portion of Hulsey (28 acres), a portion of Bear Wallow Wilderness Addition Southeast (88 acres), and all of Bear Wallow Wilderness Addition Northwest (172 acres). The Escudilla Wilderness Additions are slightly smaller than the potential wilderness areas to address manageability concerns on Terry Flat and along two roads. Also, an area in the southwest corner, south of Bob Thomas Creek where the road prism of a decommissioned road is still very evident, was not recommended. The additions to Escudilla Wilderness would more than double the size of the wilderness and would extend the north, east, and south wilderness boundary to identifiable features on the ground, including Forest Road (FR) 275. The only portions of Bear Wallow Wilderness Addition Southeast included in **alternative B** are two small parcels between the southeastern wilderness boundary and FR 54; these additions would improve manageability. These additions would supplement the existing biological diversity and naturalness and would enhance the outstanding opportunities for solitude and primitive and unconfined recreation found in Escudilla and Bear Wallow Wilderness areas.

This recommendation includes about 380 acres that would require additional action before designation, including decommissioning 2.3 miles of engineered timber sale roads and reducing signs of past timber treatments (approximately 278 acres).

Alternative C includes approximately 6,982 acres of Recommended Wilderness Management Area (figure 90 in appendix J) as an addition to Escudilla Wilderness. This addition would improve manageability because the wilderness boundary would be more identifiable by the public and Forest Service employees. There is some local public support for enlarging Escudilla Wilderness.

Additional potential wilderness areas are not recommended for wilderness under **alternative C** because of the alternative emphasis on providing forest products for local and regional industry and personal use. To accomplish this, mechanical treatments are the primary method to restore ecosystems and reduce divergence of the forests’ PNVTs from desired conditions. Additional wilderness is also not recommended to allow for the **alternative C** emphasis on motorized and developed recreation opportunities.

Several areas identified as potential wilderness, but not recommended for wilderness, would be managed under Natural Landscape Management Area direction, which would help maintain the wilderness characteristics. Other areas would be managed according to management area or special area direction, which may or may not maintain wilderness characteristics. The additions to Bear Wallow Wilderness were not included in this alternative to reflect public concerns.

This recommendation could increase the wilderness acreage on the Apache-Sitgreaves NFs and would improve boundary recognition of one wilderness area. It would contribute to meeting regional needs because the lands contain six ecosystems that are underrepresented in wilderness in the Southwestern Region.

The potential wilderness areas recommended for wilderness include Escudilla Wilderness Additions Southeast and Northwest (6,663 acres), a portion of Escudilla North (291 acres), and a small portion of Hulsey (28 acres). The Escudilla Wilderness Additions are slightly smaller than the potential wilderness areas because an area in the southwest corner, south of Bob Thomas Creek where the road prism of a decommissioned road is still very evident, was not recommended. The additions to Escudilla Wilderness would more than double the size of the wilderness and would extend the north, east, and south wilderness boundary to identifiable features on the ground, including FR 275. These additions would supplement the existing biological diversity and naturalness and would enhance the outstanding opportunities for solitude and primitive and unconfined recreation found in Escudilla Wilderness.

This recommendation would include about 320 acres that would require additional action before designation, including decommissioning 1.2 miles of engineered timber sale roads and reducing signs of past timber treatments (approximately 270 acres).

Alternative D includes 491,302 acres of recommended wilderness (figures 91 and 92 in appendix J). This includes most of the potential wilderness acreage; it does not include the Hells Hole, Nolan, and Mother Hubbard potential wilderness areas (decisions on these areas are deferred until the Gila NF completes plan revision), small areas to accommodate other management areas (e.g., Energy Corridor Management Area) and the Phelps Cabin Research Natural Area, because it already has a special designation. The above acres include 2,981 acres on the Coconino NF and 3,607 acres on the Gila NF (The Apache-Sitgreaves NFs took the lead on evaluating and recommending these areas because they are contiguous to larger recommended areas on the forests).

Alternative D includes additions to all three wilderness areas on the forests and the Blue Range Primitive Area. These additions would improve manageability because the boundaries would be more identifiable by the public and Forest Service employees. Boundary recognition of Escudilla and Bear Wallow Wilderness areas would be improved as described under **alternative B**. Identification of the Mount Baldy Wilderness boundary would be improved as much of the east boundary would be near State Highway 273. The additions would supplement the existing biodiversity and naturalness and would enhance the outstanding opportunities for solitude and primitive and unconfined recreation found in the three wilderness areas and the Blue Range Primitive Area. This alternative responds to local and regional support for additional wilderness on the Apache-Sitgreaves NFs.

Alternative D's emphasis on wildland fire as the primary treatment to restore ecosystems and reduce divergence of the forests' PNVTs from desired conditions is compatible with this wilderness recommendation. The additional recommended wilderness supports the **alternative D** emphasis on nonmotorized and dispersed recreation opportunities.

This recommendation would contribute to meeting the regional need for additional wilderness because of the proximity of several recommended areas in the western and southern portions of the forests to the population centers of Flagstaff, Phoenix, and Tucson. The recommended wilderness would add lands containing 3 underrepresented landforms and 10 underrepresented ecosystems to the wilderness system in the Southwestern Region. Inclusion of this alternative in the FEIS provides a range of recommended wilderness to be analyzed. The responsible official could choose from the areas analyzed in **alternative D** to develop a new recommended wilderness alternative for the FEIS.

This recommendation includes about 8,471 acres in the Escudilla Mountain area that would require additional action before designation, including decommissioning 36.4 miles of engineered timber sale roads and reducing signs of past timber treatments (approximately 3,300 acres).

Environmental Consequences of Wilderness Recommendation

A detailed evaluation of environmental consequences, including a listing of overall effects of wilderness and non-wilderness recommendations can be found in the “Wilderness Resources and Inventoried Roadless Areas Specialist Report” (Forest Service, 2014x).

Wilderness Characteristics

Wilderness characteristics are naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and special features and values. Recommending an area with these characteristics for wilderness would protect them. The amount of recommended wilderness varies by alternative. **Alternative D** would protect the most wilderness characteristics, while **alternative A** would protect the least. **Alternatives B and C** would protect slightly more than a**lternative A**.

Alternative D would provide the most opportunities for a wilderness experience through the increased acreage recommended for wilderness. Because of the increased opportunities for a wilderness experience under this alternative, the greatest opportunity exists to reduce pressure and crowding in wilderness. By distributing wilderness use across more wilderness areas, the ability to protect wilderness characteristics also increases. **Alternative A** does not propose any additional wilderness acreage and would not disperse wilderness use on the forests. Under **alternatives B and C**, dispersal of wilderness use would be small because of the nominal increase in wilderness and because these alternatives do not add new stand-alone areas. However, **alternatives B and C** would provide more primitive and unconfined recreation opportunities than **alternative A** but much less than **alternative D**.

Non-wilderness Values

Motorized, Mechanized, and Developed Recreation

Recommended wilderness could affect the location and amount of future recreation developments and facilities, including motorized use areas and trails. **Alternative D** would provide the least opportunity for future recreation development, while **alternative A** would provide the most because more land would be available for these uses. **Alternatives B and C** would provide slightly fewer motorized and developed recreation opportunities than **alternative A**. Also, those desiring motorized recreation opportunities would be displaced to other appropriate management areas across the forests. This may cause added pressure and increased potential for crowding in those management areas. **Alternative D** would have the most potential for motorized displacement, followed by **alternatives B, C, and A**, in order of displacement potential.

Mechanized recreation or mechanical transport (e.g., mountain biking) would not be affected in **alternative A**, because no lands are recommended for wilderness. **Alternatives B and C** would not allow mechanized travel in recommended wilderness, which would slightly decrease the amount of the forests available for mechanized recreation, but there should be no effects to mechanized recreation because there are no NFS trails in the Recommended Wilderness Management Area. **Alternative D** would also not affect mechanized recreation, because mechanized travel would be allowed in the Recommended Wilderness Management Area.

Wildlife Species/Populations/Management Needs

Recommended wilderness would provide greater protection for wildlife and wildlife habitats because of reduced disturbance from motorized vehicle use. **Alternative D**, with the most recommended wilderness, would provide the most protection, while **alternative A** would provide the least. **Alternatives B and C** would provide slightly more protection than **alternative A**.

Water Use

There would be no effects to water use under **all alternatives**.

Livestock Operations

There would be no effects to livestock operations under **all alternatives**.

Vegetation Management

Recommended wilderness would affect the ability to mechanically treat vegetation to restore ecosystems and reduce fuel loading. The ability to use wildland fire as a vegetation treatment would not be restricted under **all alternatives**. **Alternative D**, with the most recommended wilderness, would place the most restrictions on where mechanical treatments may be conducted; while **alternative A** would have the most lands available for mechanical treatment. **Alternatives B and C** would have slightly less land available than **alternative A**.

Minerals

Recommended wilderness would not be withdrawn from mineral entry and leasing under the **action alternatives**. Oil, gas, geothermal, and mineral development could be constrained by terms and conditions that would protect the wilderness character and provide for restoration of disturbed lands. A full range of mineral activities would be allowed under **alternative A**.

Cultural Resources

Recommended wilderness would protect cultural resources through restrictions on motorized vehicle use. **Alternative D**, with the most recommended wilderness, would protect the most cultural resources, while **alternative A** would protect the least. **Alternatives B and C** would protect slightly more cultural resources than **alternative A**.

Authorized and Potential Land Uses

Recommended wilderness would not affect land uses currently permitted under special use authorizations. However, potential land use authorizations could be restricted or limited by recommended wilderness management. **Alternative D**, with the most recommended wilderness, would restrict or limit land use authorizations the most, while **alternative A** would restrict them the least. **Alternatives B and C** would limit or restrict potential land use authorizations slightly more than **alternative A**.

Fire, Insects and Disease, Non-Federal Lands

Recommended wilderness would affect how wildland fire and insect and disease outbreaks are managed. **Alternative D**, with the most recommended wilderness, would place the most restrictions on responses to these events, while **alternative A** would have the least amount of restrictions. **Alternatives B and C** would have slightly more restrictions than **alternative A**.

Development of inholdings and adjacent non-Federal lands could adversely affect wilderness characteristics of recommended wilderness. There would be no effects under **alternative A,** because no lands are recommended for wilderness. There would also be no effects under **alternatives B and C,** because there are no inholdings or non-Federal lands adjacent to recommended wilderness. Recommended wilderness could be affected under **alternative D,** because there are numerous inholdings and adjacent parcels of non-Federal land.

Social and Economics

Alternative D would respond the most to those who desire more wilderness and the least to those who do not want additional wilderness. **Alternatives B and C** would also fulfill this desire for more wilderness but to a lesser extent than **alternative D**. **Alternative A** would not meet the desire for additional wilderness, however, it does respond to the segment of the public that desires no additional wilderness and favors non-wilderness uses and values, such as timber harvesting, road construction, and recreation development.

The economic effects of the alternatives are discussed in the “Socioeconomic Resources” section. The economic impact analysis does not identify recommended wilderness as a factor that affects this resource. The major factor that changes by alternative is the amount of wood products produced. This primarily reflects the mix of treatment methods; mechanical and wildland fire. **Alternative D** emphasizes using wildland fire across the forests, while mechanical treatments are predominant under **alternative C**. Planned and unplanned ignitions are acceptable in recommended wilderness, while mechanical treatments are not.

Management of Areas Recommended for Wilderness

Those areas recommended for wilderness would be managed under the Recommended Wilderness Management Area direction. The focus of this management area is to manage these areas to protect their wilderness characteristics pending legislation and designation and to provide for existing uses where compatible. The following discussion focuses on the effects of managing under Recommended Wilderness Management Area direction in the **action alternatives** because no areas are recommended for wilderness in **alternative A**.

Motorized travel would not be allowed under **all alternatives**. For example, the use of motor vehicles, motorboats, and the landing of aircraft, including helicopters, would not be allowed, except under special circumstances as analyzed and authorized following the use of the “Minimum Requirements Decision Guide” (USDA and USDOI, 2012). Recommendation of areas for wilderness would eliminate opportunities for motorized recreation activities and recreation facilities. Dispersed recreation that includes nonmotorized activities (e.g., hiking, backpacking, fishing, hunting, horseback riding, cross-country skiing) would be allowed under **all alternatives**. The use of motorized equipment (e.g., chain saws) would not be allowed.

Mechanized travel or mechanical transport (e.g., bicycles, game carriers) in recommended wilderness would not be allowed under **alternatives B and C**. However, **alternative D** would allow mechanized travel or mechanical transport in recommended wilderness.

Wilderness designation may warrant future public use restrictions by limiting visitor use and distribution including setting of group size limits to preserve an area's wilderness character. Currently, there are no restrictions on group size in areas recommended for wilderness.

Recommended wilderness would be managed to provide opportunities for solitude and a primitive or unconfined type of recreation. New facilities for user comfort would not be allowed in areas recommended for wilderness.

Mechanical vegetation treatments to achieve healthy forest conditions or wildlife, recreation, and scenic integrity objectives would not be allowed in areas recommended for wilderness. Vegetation treatments that include planned (prescribed fire) and unplanned (wildfire) ignitions could occur.

Recommended wilderness may affect motorized users of non-wilderness under **all alternatives**. As the acres of recommended wilderness increase, acres suitable for future consideration of motorized recreation (roads, trails, and areas) would decrease. Therefore, increasing recommended wilderness could increase pressure on non-wilderness lands that provide motorized recreation. Added pressure and subsequent crowding would also increase because of growing demand.

There would be no effects to mechanized users of recommended wilderness because there are no NFS trails in the areas recommended under **alternatives B and C**. Mechanized travel would be allowed on NFS trails in recommended wilderness under **alternative D**. However, mechanized travel has the potential to affect solitude, increase trail maintenance needs, and could be difficult to remove the use in any area should wilderness designation occur.

Cumulative Environmental Consequences

The cumulative effects analysis area includes the adjoining federally managed lands: Coconino, Gila, and Tonto NFs and BLM Safford Field Office. There are three areas (Mother Hubbard, Nolan, and Hells Hole) that straddle the Gila NF/Apache-Sitgreaves NFs boundary. The Apache-Sitgreaves NFs has evaluated the Arizona portions of these areas and has found that each has wilderness characteristics. However, any decisions on these areas have been deferred until the New Mexico portions of these areas have been evaluated and recommendations have been made in the Gila NF plan revision process. The areas would be managed to protect their wilderness characteristics until a decision is made. The Gila NF is expected to initiate its plan revision effort in the near future. There could be an increase in lands managed to maintain and protect wilderness characteristics, should the Gila NF recommend the three areas on the Apache-Sitgreaves NFs and adjacent lands on the Gila NF for wilderness designation.

There would be no known cumulative environmental consequences to wilderness resources under **all alternatives** because there are no known foreseeable effects from activities on adjacent lands.

Research Natural Areas

This section describes the current condition and evaluates and discloses the potential environmental consequences for the two special areas—research natural areas (RNAs) and botanical areas—which may result with the adoption of a revised land management plan.

In determining the future need for RNAs, the interdisciplinary team followed the regional work group process "Research Natural Area Process for Forest Plan Revision Under the 1982 Planning Rule Provisions" (Forest Service, 2009c). Details of the Apache-Sitgreaves NFs' RNA evaluation can be found in the "Research Natural Area Specialist Report" (Forest Service, 2014p) available in the "Plan Set of Documents." The specialist report also contains full descriptions and maps of each RNA.

In the analysis for this resource, assumptions include the following:

- In all alternatives (because they must conform to Forest Service Manual 4063 direction), both designated and recommended RNAs are protected and maintained in a natural condition for the purpose of conducting non-manipulative research[36] and for fostering education. RNAs are managed for nonmotorized access. Recreation use may be restricted or prohibited if use threatens or interferes with the objectives of the RNA. Logging and wood gathering activities are not permitted. Livestock grazing may occur where needed to establish or maintain vegetative communities.
- In all alternatives, completion of RNA designations and establishment reports would depend on agency capacity (e.g., staffing, budget). Implementation of establishment reports and management plans should provide additional emphasis toward meeting the desired conditions of the RNAs. Until designation, recommended RNAs would be managed to protect and maintain a natural condition.
- Following approval of the plan, further evaluation and a NEPA environmental assessment would be completed for each recommended RNA. If approved by the regional forester, with concurrence of the station director, the plan would then be amended to recognize these areas as designated RNAs.
- Recommended RNAs would be designated within 5 years of the plan's record of decision or a plan amendment would be completed to return the land area to other management.

Affected Environment

Research natural areas (RNAs) are considered special areas by the Forest Service. RNAs are part of a national network of natural areas designated in perpetuity for research and education and/or to maintain biological diversity on NFS lands. RNAs are principally for non-manipulative research, observation, and study. They also may assist in implementing provisions of special acts, such as the Endangered Species Act of 1973 and the monitoring provisions of the National Forest Management Act of 1976 (Forest Service Manual 4063).

RNAs are defined (Forest Service Manual 4063.05) as,

[36] However, if necessary to further research, RNAs can be used for manipulative research purposes to help quantify and understand ecosystem processes and to improve forest management practices.

> [P]hysical or biological units in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation may be utilized to maintain the unique feature that the RNA was established to protect.

The objectives (Forest Service Manual 4063.02) of establishing RNAs are to:

- Maintain a wide spectrum of high quality representative areas that represent the major forms of variability found in forest, shrubland, grassland, alpine, and other vegetation types, and natural landscapes that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity.
- Preserve and maintain genetic diversity, including threatened, endangered, and sensitive species.
- Protect against human-caused environmental disruptions.
- Serve as reference areas for the study of natural ecological processes including disturbance.
- Provide onsite and extension educational activities.
- Serve as baseline areas for measuring long-term ecological changes.
- Serve as control areas for comparing results from manipulative research.
- Monitor effects of resource management techniques and practices.

The Apache-Sitgreaves NFs currently have one designated RNA, Phelps Cabin, and one designated botanical area, Phelps Cabin Botanical Area. The 1987 plan recommended four RNAs: Thomas Creek, Escudilla Mountain, Wildcat, and Hayground (see table 125 below).

During the plan revision process, an evaluation (Forest Service, 2014p) was conducted to determine the need for existing or additional RNAs. The primary criterion for determining need was the lack of ecological representation in the RNA system regionwide. In addition to the designated RNA and the RNAs recommended in the 1987 plan, four other areas were also evaluated: Three Forks, Lower Campbell Blue, Corduroy, and Sandrock.

Table 125 displays the results of the evaluation. In order to better contribute to the regionwide need for RNAs, it is recommended that the Apache-Sitgreaves NFs (1) retain the existing Phelps Cabin RNA and add the Phelps Botanical Area to the RNA, (2) withdraw three currently recommended RNAs (Escudilla Mountain, Hayground, and Wildcat), (3) continue to recommend the Thomas Creek RNA, and (4) recommend four new RNAs (Three Forks, Lower Campbell Blue, Sandrock, and Corduroy).

Table 125. Results of the Apache-Sitgreaves NFs' RNA evaluation showing ecological types needed in the regionwide RNA system and whether specific areas should be recommended or withdrawn

Name	Status	Size (aprx. acres)	RF[a]	PJW[b]	PPF[c]	SDG[d]	WCRA[e]	Recommend or Withdraw
Phelps Cabin	Existing designated RNA	290[f]	X				X	Recommend, with addition of the Phelps Botanical Area
Escudilla Mountain	Recommended in the 1987 plan	960					X	Withdraw, spruce-fir forest and montane/subalpine grasslands are already well-represented in the region. The area is within Escudilla Wilderness.
Thomas Creek	Recommended in the 1987 plan	550						Recommend, although this area does not contribute to the regional need, it is a control area for watershed research.
Wildcat	Recommended in the 1987 plan	530	X	X	X			Withdraw, this area no longer provides undisturbed old growth piñon-juniper.
Hayground	Recommended in the 1987 plan	400	X				X	Withdraw, ecological representation found in other designated and recommended RNAs.
Three Forks	Evaluated during plan revision	2,900	X		X		X	Recommend, this area also contains unique aquatic habitat (fens) and wildlife species.
Lower Campbell Blue	Evaluated during plan revision	580	X		X			Recommend, this area also contains springs and perennial creeks.
Sandrock	Evaluated during plan revision	530				X		Recommend, small portion of the area was set aside in the 1987 plan to aid watershed recovery.
Corduroy	Evaluated during plan revision	3,350	X		X			Recommend, this area also contains aspen.

[a] Riparian Forest

[b] Piñon-Juniper Woodland

[c] Ponderosa Pine Forest

[d] Semi-Desert Grassland

[e] Wetland/Cienega Riparian Areas

[f] Approximately 120 acres of this RNA are located in Mount Baldy Wilderness

Environmental Consequences of Alternatives

Alternative A would continue current management with one designated RNA (Phelps Cabin) and four recommended RNAs (Thomas Creek, Escudilla Mountain, Wildcat, and Hayground). The Phelps Botanical Area would continue to be managed as a separate special area. **Alternative A** would not contribute to the regional need for additional RNAs with the recommendation of Wildcat because it fulfills the regional need for riparian forest, piñon-juniper woodland, and ponderosa pine forest (see figure 61).

Alternatives B and C would combine the Phelps Cabin RNA and the Phelps Botanical Area into one special area, the Phelps Cabin RNA. This would increase the existing designated RNA by approximately 100 acres. These alternatives would also recommend five RNAs (Thomas Creek, Three Forks, Lower Campbell Blue, Sandrock, and Corduroy). In addition, these alternatives would also recommend withdrawing the existing RNA recommendations for Escudilla Mountain, Wildcat, and Hayground. These alternatives contribute to the regional need for additional RNAs by providing representation in four ecological types (see figure 62 and table 126).

Alternative D would combine the Phelps Cabin RNA and the Phelps Botanical Area into one special area, the Phelps Cabin RNA. This would increase the existing designated RNA by approximately 100 acres. This alternative also recommends two RNAs (Corduroy and Three Forks). The other areas (Thomas Creek, Lower Campbell Blue, and Sandrock) are located in the Recommended Wilderness Management Area where there is no need for RNA designation. In addition, this alternative would also recommend withdrawing the existing RNA recommendations for Escudilla Mountain, Wildcat, and Hayground. This alternative contributes to the regional need for additional RNAs by providing representation in three ecological types (see figure 63 and table 126).

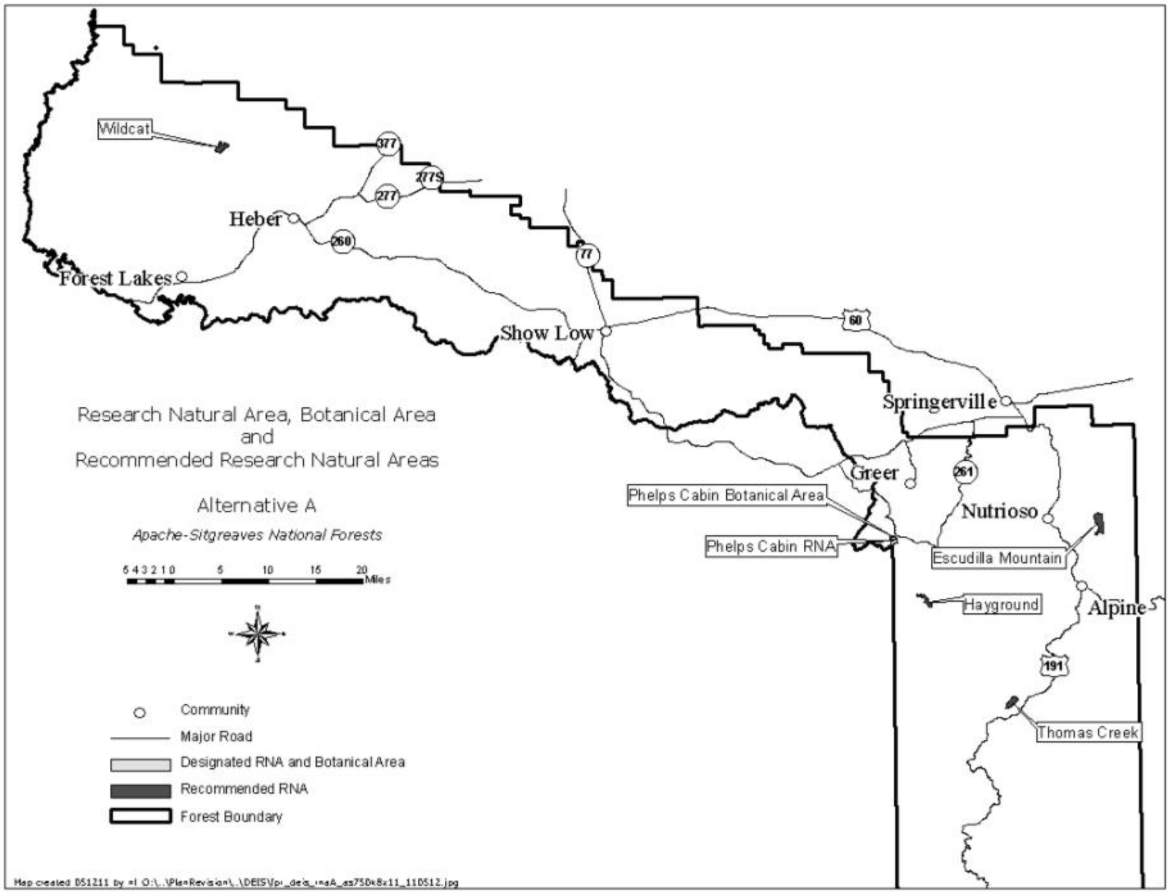

Figure 61. Map of research natural area (RNA), botanical area, and recommended RNAs, alternative A

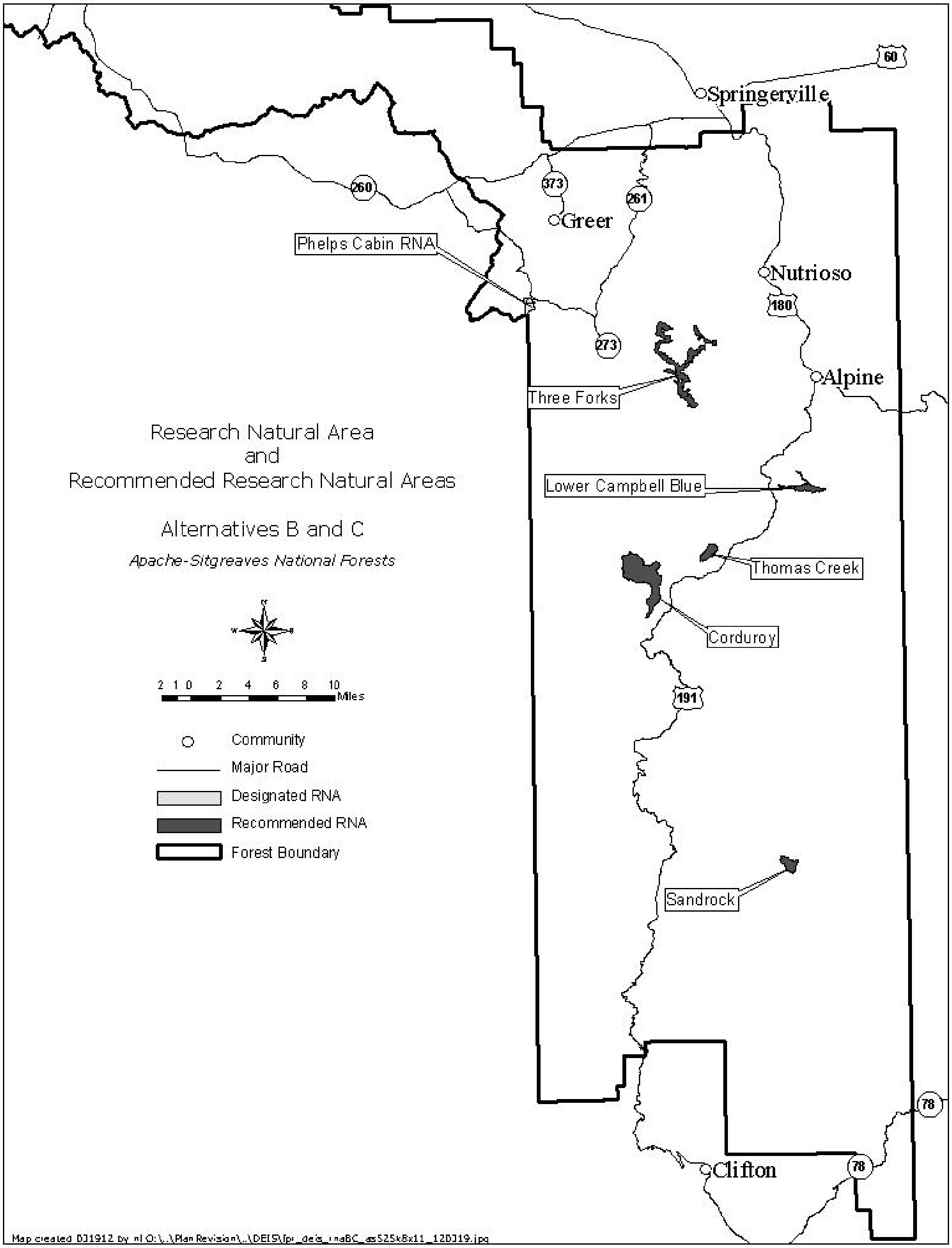

Figure 62. Map of research natural area (RNA), botanical area, and recommended RNAs, alternatives B and C

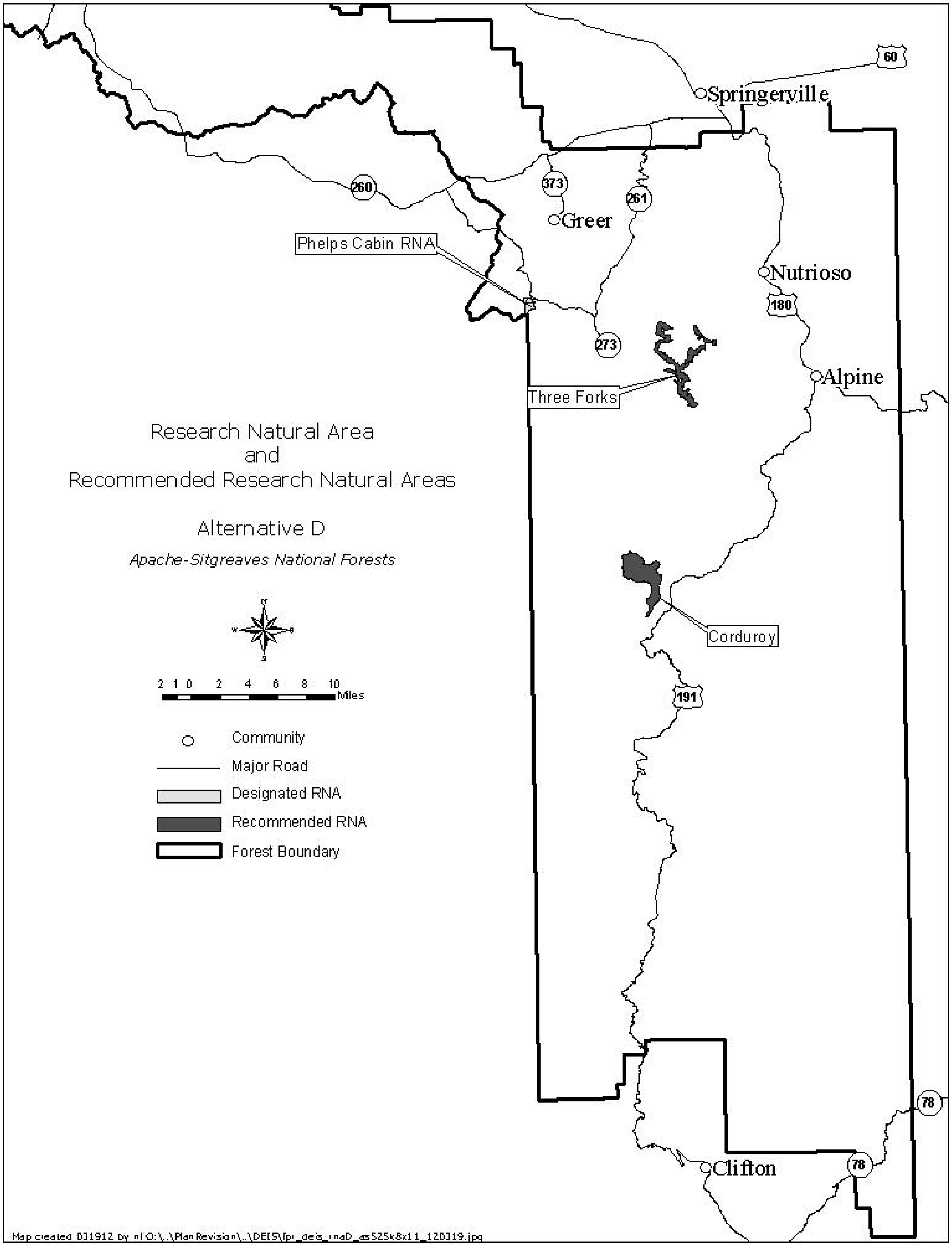

Figure 63. Map of research natural area (RNA), botanical area, and recommended RNAs, alternative D

Alternatives B, C, and D, because they have the greatest number and acreage of RNAs, would have the most beneficial cumulative consequences to other resources such as water, riparian areas, and species habitat because of the non-manipulative management emphasis in these areas.

All of the alternatives would contribute areas to the regional network of RNAs if the recommended RNAs are selected and designated. The **action alternatives** would add ecological representation to the system, with **alternatives B and C** providing the greatest contribution. While **alternative A** would have the fewest acres managed in RNAs, **all alternatives** would allocate less than 1 percent of the forests as RNAs (see table 126).

Table 126. Number and amount of designated and recommended RNAs by alternative

Quantity	Alt. A	Alt. B	Alt. C	Alt. D
Number of Designated RNAs	1	1	1	1
Number of Recommended RNAs	4	5	5	2
Acres in Designated and Recommended RNAs[a]	2,549	8,075	8,075	6,218
Percent of Apache-Sitgreaves NFs[b] in Designated and Recommended RNAs	< 1%	< 1%	< 1%	< 1%

[a] Based on management area acreage
[b] Total forests acreage is over 2.1 million

RNAs, because of their non-manipulative management emphasis, contribute to achieving many of the proposed plan's desired conditions, in particular those that call for restoration of natural ecological processes and opportunities for research and study.

Extractive (minerals, oil and gas) or ground-disturbing activities (timber management, road maintenance) could occur in the vicinity of RNAs. Such activities could lead to environmental consequences such as riparian impacts within RNAs from upstream activity; however, the consequences would be minor because Forest Service actions would conform to plan standards and guidelines for protecting water resources and riparian areas.

Although grazing is allowed in RNAs, there should be limited consequences to livestock grazing because only one of the RNAs is permitted for livestock grazing (Thomas Creek RNA). See table 127.

Grazing by wildlife, especially elk, could impact the Phelps Cabin, Wildcat, Hayground, Three Forks, Lower Campbell Blue, and Corduroy RNAs by altering the amount and composition of key vegetative components, such as willow and aspen. However, implementation of the plan guideline to use management measures (e.g., fencing) to protect unique features should minimize the impact.

Table 127. Status of grazing allotments containing recommended RNAs

Recommended RNA	Livestock Grazing Status
Sandrock	Located within the Sandrock Allotment which was closed to grazing in 1987 and is not allocated under a grazing permit.
Lower Campbell Blue	Located within the Lower Campbell Blue Allotment which was waived back to the Forest Service in 2001 is under nonuse, and is not allocated under a grazing permit.
Corduroy	Located within the Hannagan Allotment which was waived back to the Forest Service in 2001 is under nonuse, and is not allocated under a grazing permit.
Three Forks	Located within the Black River Allotment which was waived back to the Forest Service in 2002 is under nonuse, and is not allocated under a grazing permit.
Thomas Creek	Located within the West Thomas pasture of the Foote Creek Allotment where livestock grazing only occurs after August 31 for Mexican spotted owl habitat recovery and to protect RNA values.

Cumulative Environmental Consequences

The cumulative environmental consequences analysis area is the Apache-Sitgreaves NFs, Arizona and New Mexico National Forest System lands, and the regional network of RNAs. It is reasonably foreseeable that the other Arizona and New Mexico national forests would recommend new RNAs during their plan revision efforts. With the addition of RNAs recommended in **all alternatives**, this may result in more areas recommended than are actually needed in the regional RNA system and may trigger a need to withdraw areas recommended in the Apache-Sitgreaves NFs plan.

Because the RNAs are located within the interior of the forests, activities occurring off-forests should have no or extremely limited impacts. Establishment of RNAs on the forests should contribute to the vegetation communities within the existing RNAs system and provide a potential scientific basis for climate change research. The forests' RNAs would also be complementary to those on the Gila, Coconino, Coronado, and Tonto NFs, as well as those within the Bureau of Land Management.

Scenic Resources

This section describes the affected environment and evaluates and discloses the potential environmental consequences to scenic resources. The criteria for evaluating the potential level of alteration to the landscape are measured by acres of each scenic integrity level (SIL) by alternative and a qualitative discussion of the potential effects to scenic resources from management activities. As part of the plan revision process, the Forest Service completed a new scenic inventory of the Apache-Sitgreaves NFs in 2009. For more information, see the "Scenic Resources Specialist Report" (Forest Service, 2014r) in the "Plan Set of Documents."

In the analysis for this resource, assumptions include the following:

- When a decision is made on the land management plan, the scenic integrity levels (SILs) would become the scenic integrity objectives (SIOs) and would be used to manage the scenic resources over the planning period. This analysis looks at the SILs by alternative to determine the effects to scenic resources as variations in management activities and management areas occur.

- SIOs, at the project level, set the acceptable level of alteration to the characteristic landscape, based on the importance of the landscape. Mitigation measures will be developed and applied at the project level.
- In May and June of 2011, the Wallow Fire burned over 538,000 acres on the Apache NF and adjoining ownerships. Many trees in the forested areas were killed; while others are likely to die. Flooding and increased erosion have occurred and will continue for several years. Aspen regeneration is expected across much of the burned area, which may result in more widespread fall color displays. The Wallow Fire does not change the proposed scenic integrity levels (and objectives) because they are tied to management areas and resource features.

Affected Environment

The Apache-Sitgreaves NFs contain some of the most scenic landscapes in the State of Arizona, ranging from rugged canyons to rolling hills and grasslands to conifer forests. Scenic resources contribute to visitor satisfaction and enjoyment of the forests. Popular visitor activities include viewing natural features, landscapes, and wildlife (Kocis et al., 2002).

Existing Landscapes

The Apache-Sitgreaves NFs lie within the White Mountains-San Francisco Peaks-Mogollon Rim Ecoregion (see figure 44). This ecoregion section is located on the Colorado Plateau in central and east-central Arizona and west-central New Mexico. Geomorphic processes active in this section involve recent volcanism including basaltic lava flows, cinder cone eruptions, and volcanic ash. Major landforms include mountains, plains, plateaus, and hills. Elevations on the forests range from 3,600 feet to over 11,000 feet.

Precipitation ranges from 20 inches to over 32 inches annually, with more than half of the precipitation falling during the winter. Winters are cold with the growing season ranging from less than 50 days to 110 days.

Plant communities vary with ponderosa pine and Gambel oak on warm and dry sites; white fir and Douglas-fir on cool, moist sites; and Engelmann spruce, blue spruce, and subalpine fir or corkbark fir on the coldest, wettest sites.

Historically, fires occurred naturally in ponderosa pine forests about every 2 to 17 years, but they currently occur less frequently because of fire suppression and other management activities. This has led to thicker forests and increased fuel loads, resulting in a less resilient ecosystem and an increased risk of uncharacteristic wildfire. Current land uses include a wide variety of recreation activities, grazing, and fuels reduction.

The Apache-Sitgreaves NFs can generally be divided into three landscapes: high plateau, volcanic highlands, and below the Mogollon Rim. The Mogollon Rim, a 2,000-foot escarpment, is a dominant feature across the forests (see figure 64).

High Plateau

Most of the Sitgreaves NF is included in the High Plateau. This broad, rolling landscape extends from Leonard Canyon on the west to the Show Low area on the east and extends north from the Mogollon Rim. Large stands of ponderosa pine, mixed conifers, and aspen cover the southern portion of this area, while piñon-juniper woodlands and grasslands blanket the northern band. This elevated plain provides spectacular vistas, both north and south, especially along Forest Road (FR) 300 and State Highway (SH) 260. This rolling landscape is dissected by rugged, steep-walled sandstone and limestone canyons that drain north to the Little Colorado River. There are essentially no roads in the canyons; however, a road network covers the uplands and provides access for motorized and nonmotorized recreation.

Developed recreation opportunities are plentiful, especially in the Woods Canyon Lake, Willow Springs Lake, and Fool Hollow Lake areas. An abundance of snow in the winter months provides opportunities for snowshoeing, cross-country skiing, and snowmobiling. This area is a favorite of both summer and winter recreationists because it is less than 2 hours from the Phoenix metropolitan area. Outside the developed recreation areas, the landscape has been, and continues to be, a favorite spot for traditional activities such as camping, hunting, fishing, and firewood and piñon nut gathering. SH 260 is the primary east-west transportation corridor, while SHs 77, 277, and 377 provide access to the north and U.S. Highway (US) 60 provides access to the south and east. Two major energy corridors cross this landscape. Most of the area south of SH 260 was burned during the 2002 Rodeo-Chediski Fire and is currently in a state of transition with remnant burned snags and new vegetative growth. The towns of Show Low and Pinetop-Lakeside, near the eastern edge, are the residential, commercial, and tourist hub of the Apache-Sitgreaves NFs. Most forest visitors to the eastern portion of this landscape participate in day-use recreation activities and return to their urban accommodations at night.

Volcanic Uplands

East of Show Low, the landscape transitions into the Volcanic Uplands with volcanic peaks, basalt flows, cinder cones, and vast high-elevation grasslands. This landscape continues east to the New Mexico State line and south to the Mogollon Rim. High mountains and river canyons are prominent features of the landscape. Vegetation includes piñon-juniper woodlands, grasslands, ponderosa pine and mixed conifer forests, aspen, lush riparian areas, and the forests' largest concentration of spruce-fir forest. The headwaters of several major Arizona rivers, including the Little Colorado, Black, Blue, and San Francisco, are found in this landscape. Mount Baldy and Escudilla Mountain dominate the landscape in the northern portion of this area.

Two scenic byways, the Coronado Trail National Scenic Byway and the White Mountain Scenic Road, provide motorized corridors for viewing vegetation, wildlife, and landforms that combine to provide some of the most spectacular scenery on the forests. Viewing fall colors and wildlife, such as elk and eagles, are major activities. Residents of the communities of Alpine, Eagar, Greer, Nutrioso, and Springerville consider this area their backyard and participate in traditional activities such as hunting, fishing, and firewood gathering.

Recreationists participate in an array of activities such as camping, hiking, biking, OHV riding, cross-country skiing, and snowmobiling. Developed campgrounds and dispersed camp areas are destinations for many visitors who seek relief from hot desert temperatures. All three wilderness areas on the forests can be found here: Bear Wallow, Escudilla, and Mount Baldy. Water is a primary draw for recreationists with popular sites including Big Lake, Lee Valley Reservoir, and the East and West Forks of the Black River. Most of this landscape was burned during the 2011 Wallow Fire; the forested lands are in a state of transition with burned snags and new vegetative growth. SH 260 and US 60 are the primary east-west transportation corridors, US 180 and 191 provide access to the north, southeast, and south.

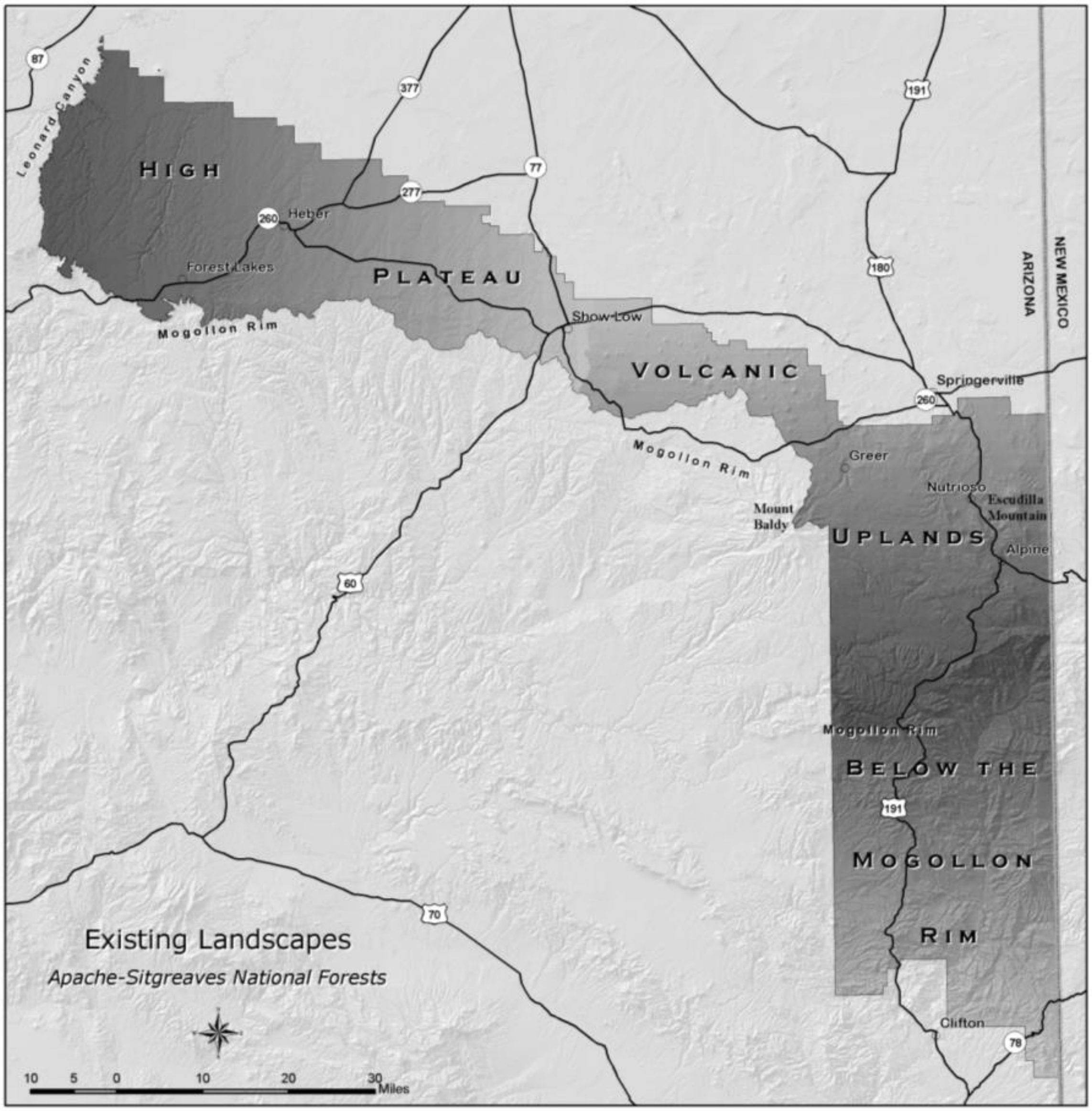

Figure 64. Map of three major existing landscapes on the Apache-Sitgreaves NFs

Below the Mogollon Rim

Below the Mogollon Rim, the landscape is drier and harsher with more rugged topographic features. Elevations range from 9,200 feet on the Mogollon Rim to 3,600 feet on the San Francisco River. Unique rock formations, steep canyons, mesas, and broad valleys characterize the landscape. Vegetation changes with elevation, ranging from ponderosa pine and mixed conifer forests on the Mogollon Rim through pine-oak woodlands and chaparral to semi-desert grasslands in the south. Riparian forests are found along the major rivers and creeks. Wildlife viewing abounds with opportunities to see bighorn sheep, coatimundi, and rare birds such as peregrine falcon, wintering bald eagles, and common black-hawks.

There are few roads in this area, but nonmotorized trails are plentiful. Most recreationists enjoy dispersed activities such as camping, hiking, horseback riding, hunting, birding, and OHV riding. Most of the Blue Range Primitive Area is in this landscape. The Blue River, San Francisco River, and Eagle Creek are the major waterways. This landscape contains extensive archaeological remnants of the Mogollon culture, the native people that lived here thousands of years ago. Present day residents have strong ties to the land and use the forest in traditional ways including ranching and guiding big game hunts. Portions of the upper Blue River drainage were burned during the 2011 Wallow Fire; the forested lands are in a state of transition with burned snags and new vegetative growth. US 191 is the primary north-south transportation corridor; while SH 78 provides access to US 191 from the east.

Current Management

The Apache-Sitgreaves NFs currently manage scenic resources with the Visual Management System (VMS), which was adopted by the Forest Service in 1974. This system was used to derive visual quality objectives (VQO) for all lands within the Apache-Sitgreaves NFs. VQOs are based on three factors: (1) the variation of a landscape; (2) the level of concern visitors have for scenic quality while viewing the landscape from certain areas or routes; and (3) the distance viewers are from the landscape or a feature on the landscape, such as a road (Forest Service, 1974).

Management direction is provided in the 1987 plan for the five VQOs, ranging from allowing almost no change to the landscape to allowing many types of changes. VQO acres are shown in table 129. The five VQOs are preservation, retention, partial retention, modification, and maximum modification.

- **Preservation (P)**: Provides for ecological changes only.
- **Retention (R)**: Management activities are generally not evident to the casual visitor.
- **Partial retention (PR)**: In general, management activities may be evident but must be subordinate to the characteristic landscape.
- **Modification (M):** Management activities may dominate the characteristic landscape, but they must at the same time utilize naturally established form, line, color, and texture. Man’s activities should appear as natural occurrences when viewed from foreground or middle ground.
- **Maximum modification (MM)**: Management activities may dominate the characteristic landscape, but they should appear as a natural occurrence when viewed as background. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground.

Future Management

The Forest Service updated the Visual Management System at the national level to the Scenery Management System (SMS) (Forest Service, 1995). SMS incorporates computerized mapping technology and applies elements and objectives at the project-level to incorporate the existing and desired landscape character. SMS is also adaptive and responds to changing ecological conditions.

The Apache-Sitgreaves NFs will transition to SMS upon completion of the plan revision process. Table 128 shows the relationship between visual quality objectives (VQOs) and scenic integrity objectives (SIOs) used in SMS.

Table 128. Crosswalk between Visual Management System and Scenery Management System

VQO from VMS	Degree of Landscape Alteration	SIO from SMS
Preservation (P)	Unaltered	Very High (VH)
Retention (R)	Appears Unaltered	High (H)
Partial Retention (PR)	Slightly Altered	Moderate (M)
Modification (M)	Moderately Altered	Low (L)
Maximum Modification (MM)	Heavily Altered	Very Low (VL)

The SILs (pre-decision)/SIOs (post-decision) are described below, ranging from allowing almost no change to the landscape to allowing many types of changes:

- **Very High (VH)**: Refers to landscapes where the valued landscape character "is intact" with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level.
- **High (H)**: Refers to landscapes where the valued landscape character "appears intact." Deviations may be present, but they must repeat form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
- **Moderate (M)**: Refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low (L)**: Refers to landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character being viewed, but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but compatible or complimentary to the character within.
- **Very Low (VL**): Refers to landscapes where the valued landscape character "appears heavily altered." Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

Environmental Consequences of Alternatives

The SIL acreages for the alternatives are summarized in table 129 and shown in figure 65. More detailed descriptions of how the SILs vary by alternative, including how they vary by management area, can be found in the "Scenic Resources Specialist Report" (Forest Service, 2014r) in the "Plan Set of Documents." Acres for **alternative A** are based on the 1987 plan VQO acres.

Table 129. Amount of NFS land (acres and percent of forests) by SIL by alternative

SIL	Alt. A[a] VQO Acres (percent)	Alt. B Acres (percent)	Alt. C Acres (percent)	Alt. D Acres (percent)
Very High	210,769 (11%)	305,047 (15%)	303,723 (15%)	748,716 (37%)
High	490,464 (25%)	786,773 (39%)	676,394 (34%)	444,302 (22%)
Moderate	835,979 (42%)	920,648 (46%)	1,032,351 (51%)	819,449 (41%)
Low	405,470 (20%)	394 (<1%)	394 (<1%)	393 (<1%)
Very Low	35,008 (2%)	2,490 (<1%)	2,490 (<1%)	2,492 (<1%)
Total	**1,977,690**	**2,015,352**	**2,015,351**	**2,015,351**

[a] Alternative A acres are those presented in the 1987 plan. These acres do not include any changes in land tenure (NFS lands acquired or disposed of) or in mapping techniques.

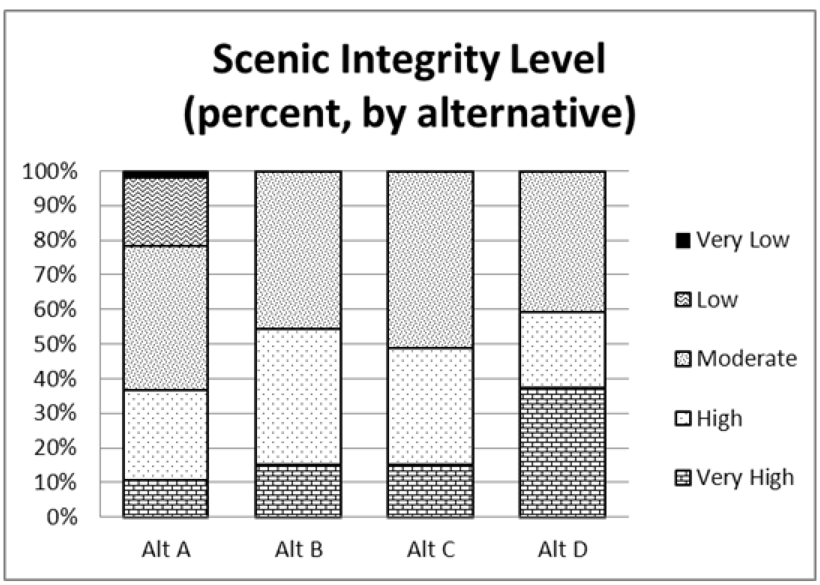

Figure 65. Percent of scenic integrity level by alternative

As shown above, **alternative A** would have a range of SILs with an emphasis on moderate scenic integrity. **Alternative B** would have more emphasis on moderate to high scenic integrity; while

alternative C would focus on moderate scenic integrity, with some emphasis on high scenic integrity. **Alternative D** would emphasize moderate and very high scenic integrity. The SILs would become SIOs in the final plan.

Continuation of the use of the Visual Management System (VMS) and visual quality objectives (VQOs) in **alternative A** would be contrary to current Forest Service policy. VMS is not an adaptive system and does not respond to changing ecological conditions as SMS does. Overall, scenic resources would be maintained at a lower scenic integrity than the **action alternatives** because of the greater acreage in the very low, low, and moderate SILs. The forests would convert to SMS under **alternative A**.

All projects implemented on the Apache-Sitgreaves NFs require a site-specific assessment of the potential effects on scenic resources. All SIOs are applied at the project-level. If needed, they may be refined at this level. The **action alternatives** would reflect a greater emphasis on scenic integrity, with fewer acres in the low and very low SILs. There would be minimal change in acreage for the low and very low SILs between the **action alternatives**. Because the low and very low SILs would not vary by **action alternative**, the following discussion focuses on the moderate, high, and very high SILs.

Alternative A would manage scenic resources under a mix of SILs with an emphasis on low, moderate, and high scenic integrity. In general, the forests would be managed for natural-appearing landscapes. However, this alternative would allow the most landscape alterations or deviations.

Alternative B would manage scenic resources under a mix of SILs with an emphasis on moderate to high scenic integrity. In general, the Apache-Sitgreaves NFs would be managed for natural appearing, intact landscapes with the exception of the Energy Corridor Management Area. Minor landscape alterations would be allowed except on the very high SIL acres. Comparable acres are managed for very high SIL under **alternatives B** and **C**. Slightly more land would be managed under the high SIL in **alternative B** than in **alternative C**. Slightly less land would be managed under the moderate SIL than in **alternative C**.

Alternative C would manage scenic resources under a mix of SILs with an emphasis on moderate scenic integrity. In general, the forests would be managed for natural appearing, intact landscapes, but it would allow slightly more landscape alterations or deviations than in **alternative B**. A majority of the acres would be managed under the moderate SIL. Less acreage in the very high SIL reflects the alternative’s emphasis on mechanical vegetation treatments and developed/motorized recreation.

Alternative D would manage scenic resources under a mix of SILs with an emphasis on very high and moderate scenic integrity. This reflects the emphasis on managing more intact landscapes and the increased acreage of lands in the Recommended Wilderness Management Area. Less acreage in the high and moderate SILs also reflects the alternative’s emphasis on primitive and semi-primitive recreation opportunities and the use of wildland fire as a vegetation management tool.

General Effects of Activities on Scenic Resources

Management activities affect scenic resources by altering the appearance of what is seen in the landscape. Short-term scenic effects from management activities are usually considered in terms of degree of visual contrast with existing or adjacent conditions. The scenic landscape can be changed over the long term or cumulatively by the alteration of the visual character. Management actions which result in visual alterations inconsistent with the assigned SIO, even with mitigation, could impact scenic resources. Management actions on the Apache-Sitgreaves NFs that have the greatest potential to affect scenic resources are vegetation management (including timber harvest and insect and disease control), energy corridor rights-of-way, prescribed fire, and wilderness recommendations. Other management activities that could affect the scenic resources are fire suppression, recreation facilities, and wildlife habitat management, but these are expected to be site specific and similar under **all alternatives**.

Vegetation and Fuels Management

Under **all alternatives**, the short-term effects related to vegetation and fuels management activities may decrease scenic integrity. However, long-term effects should increase scenic integrity by restoring ecosystem functions. Short-term negative effects to scenic resources would be the greatest under **alternative C**, which would treat more acres mechanically and potentially reconstruct more road miles than would **alternatives A, B, or D**.

Vegetation and fuels management have a high potential to alter the landscape and affect the scenic resource. Activities typically reduce scenic integrity in the short term because of the associated slash prior to prescribed fire, stumps, and landing and road construction. In the long term, treatment activities may maintain or enhance scenic integrity, scenic stability, and the ability to resist insects, disease, and uncharacteristic wildfire. Consequently, treated areas may appear moderately to highly altered for longer periods of time, depending upon the treatment and mitigation measures implemented.

Under **all alternatives**, the short-term effects of some activities may reduce the scenic quality (e.g., piles of fuels from mechanical treatments prior to prescribed fire). However, in the long term, scenic quality in **all alternatives** would be improved as progress is made toward reducing the potential for stand-replacing crown fires and moving vegetation toward desired conditions (e.g., a mosaic of structural states with openings for ponderosa pine forests) which highlight intact landscapes, high biological diversity, and resiliency to natural disturbances.

Under **all alternatives**, treatments would include thinning, cutting, and wildland fire in most of the PNVTs (table 130). Selective tree cutting could enhance scenic resources in the long term, because it may result in more open park-like groves of trees, enhance structural and species diversity, improve spatial distribution, create vistas, reduce susceptibility to high severity wildfire, and restore meadows and grasslands. Aspen cutting may result in openings with short-term negative elements (including stumps, slash, crushed trees, landings, disturbed soil and ground vegetation, and roads). In the longer term, these openings should regenerate into highly valued stands of aspen.

Fuels reduction efforts (e.g., mechanized thinning) may result in short-term decreases in scenic quality because of cut vegetation, slash, and disturbed soils. Planning for scenic elements and adherence to design criteria would minimize short-term impacts and reap long-term benefits, thereby meeting scenic integrity objectives. Fuels reduction activities should result in more resilient forest conditions, which should be better able to resist uncharacteristic wildfires.

Management efforts to control insect infestations and diseases that include removal of infected trees and buffer areas often appear as clearcutting to forest visitors. These impacts can occur in areas of high scenic value (e.g., along scenic routes) and may reduce scenic quality.

Table 130. Average annual acres of vegetation treatments by alternative

Treatment	Alt. A Acres	Alt. B Acres	Alt. C Acres	Alt. D Acres
Mechanical	12,182	19,591	23,997	15,954
Wildland Fire	6,844	28,930	12,857	48,927
Total	**19,026**	**48,521**	**36,854**	**64,881**

Energy Corridors

Energy corridor rights-of-way (ROW) have a high potential to affect scenic resources for a long duration. Cleared ROWs and utility structures contrast and may be incongruent with existing landscapes. Cleared ROWs generally contrast highly with the surrounding landscape. **All alternatives** would have similar effects from energy corridors ROWs.

Fire

All alternatives would propose wildland fire for multiple objectives. Drifting smoke, blackened vegetation, and charred tree trunks would be the primary effects to scenic resources. Blackened vegetation usually lasts a short time, but charred trees may be evident for many years. Low-intensity wildfire and prescribed fire have the potential to alter the appearance of the planning area, but they could help restore or enhance scenic integrity and ecological conditions. For example, repeated prescribed fire over time in ponderosa pine forests produces the desired condition of stands with open understories which allow views farther into the landscape. Conversely, uncharacteristic wildfires may alter scenic integrity and result in additional effects to scenic resources from fire suppression (e.g., fire line construction) or post-fire salvage logging (e.g., road construction or reconstruction).

The general effects of wildland fire would be the same under **all alternatives**. Each alternative would vary in the acreage that could be treated with wildland fire (see table 130 above). Overall, based on the average treatment objective, **alternative D** would apply wildland fire to the most acres, followed by **alternatives B, C, and A** with fewer acres treated, respectively. In addition, **alternatives D and B** would use more moderate and/or high severity fire to restore acres than **alternatives C and A**. This would result in more trees killed by fire and could alter the appearance of treated areas.

Wilderness

Management of designated wilderness and maintenance of wilderness characteristics in the Primitive Area and Recommended Wilderness Management Areas would result in landscapes that appear natural, are intact, and are unmodified by management activities because these lands are managed for very high scenic integrity. Vegetation and fuels management activities would be limited to the use of wildland fire. The effects to scenic resources from wildland fire are discussed above.

Alternative D would have the most acres in Wilderness, Primitive Area, and Recommended Wilderness Management Areas that would be managed for very high SIL and would provide the greatest scenic resource protection and maintenance. **Alternatives A, B, and C** would have the fewest acres in these management areas (very high SIL) and would provide overall lower levels of scenic resource protection.

Cumulative Environmental Consequences

The cumulative effects analysis area for scenic resources is all Federal, State, and tribal lands within a 20-mile radius of the Apache-Sitgreaves NFs. This area was selected because of ongoing and proposed activities on neighboring national forests (i.e., Four Forest Restoration Initiative), adjacent State and Bureau of Land Management (BLM) lands (i.e., renewable energy development, energy corridor developments, juniper treatments); and neighboring American Indian reservations (i.e., vegetation treatments).

Mechanical vegetation treatments are planned or proposed for much of the land within the cumulative effects analysis area. This, combined with the planned or proposed treatments on the Apache-Sitgreaves NFs in **all alternatives**, could result in cumulative effects to scenic resources. More of the landscape, in the short term, would appear to be moderately to slightly altered until the longer term scenic integrity objective is achieved. Also, differing scenic objectives by the managing agencies may result in contrasting landscapes, especially near or along administrative boundaries. For example, one agency may prefer a forested landscape with regularly spaced trees, while another may favor trees in groups or clumps with openings between them.

Renewable energy and energy corridor developments are of particular concern along and north of the Apache-Sitgreaves NFs and within and adjacent to existing energy corridors. These would be more permanent modifications to the landscape. Should solar panel arrays and additional wind farms be developed, there may be dramatic changes to the existing landscape from the physical structures. These types of energy developments would also require additional transmission lines to connect to existing energy corridors and could result in the creation of new energy corridors or expansion of existing energy corridors. The discussion of potential environmental consequences associated with energy corridors can be found in the “Lands and Special Uses” section.

Lands and Special Uses

This section compares how each alternative varies in its emphasis of meeting the demands for natural resources, addressing community expansion needs, and preserving open space by providing opportunities for land adjustments. It also compares the availability of special use authorizations for public services and benefits.

This section provides a qualitative comparison describing how the alternatives would use land adjustments to address community expansion and natural resource management needs. It also compares how the alternatives address management of property boundaries and the issue of encroachment. The section further describes how the alternatives would allow for special use authorizations and quantifies the lands that are suitable for certain uses, including energy corridors/energy development and communications sites. See the “Minerals and Energy” section for information about mineral and energy potential. The full analysis for lands and special uses can be found in the “Lands Specialist Report” (Forest Service, 2014l) available in the “Plan Set of Documents.”

In the analysis for this resource, assumptions include the following:

- The Forest Service has the personnel and funding capacity to screen, process, and manage special uses and land exchanges.
- Community and public needs for services will continue.
- The population of Arizona will continue to grow and be dependent on electricity. Consumers will continue to demand reliable electricity. The economy will fluctuate over time and influence the rate of energy corridor development.

Affected Environment

The Apache-Sitgreaves NFs are literally the backyard for many residents of the White Mountains region of Arizona. Many communities adjoin the Apache-Sitgreaves NFs; while others are completely surrounded by the forests. Because of this close proximity, many communities and private landowners are affected by forest management decisions and, in turn, they affect forest management.

Many communities are completely surrounded by the Apache-Sitgreaves NFs and, therefore, are limited in the ability to expand. Forest managers face many challenges associated with growing communities within and adjacent to the forests. As these communities and areas grow, the forests may be approached with continued requests to use Federal lands for special uses or to exchange Federal lands for private.

Land Ownership

The acquisition and disposal of National Forest System (NFS) lands are designed to consolidate interest and management of the Federal estate to enhance public benefit and to consolidate the management and ownership of Federal, State, and private lands within the proclaimed boundary of the Apache-Sitgreaves NFs. The establishment of rights-of-way is needed to create accessibility to both public and private lands within the proclaimed boundary of the forests (see figure 66 and figure 67).

There are currently 2,111,167 acres (table 131) within the proclaimed boundary of the forests, including 2,018,148[37] of NFS land. NFS land acreage within the Apache-Sitgreaves NFs has increased by 17,757 acres through land exchanges, purchases, and donation since 1987 (table 132). Land exchanges have been the principal means of ownership adjustment for the Apache-Sitgreaves NFs, with approximately 17,540 acres acquired and 4,462 acres conveyed to non-NFS ownership since 1987. Many of these land exchanges have involved the transfer of NFS lands outside the Apache-Sitgreaves NFs to other ownership; while the Apache-Sitgreaves NFs acquired non-NFS lands.

Purchase and donation have played very minor roles in the Apache-Sitgreaves NFs' land acquisition program with 215 acres acquired through purchase and the donation for the Alpine Ranger Station (1.59 acres). The primary objective of any acquisition continues to be protection of the environment and improved management of natural resources. Lands acquired are included

[37] Acres are from table 4 in the National Forest System Land Area Report (2011c) and include only lands in Arizona. They differ from the GIS acres used in this analysis because of differences in mapping techniques.

in the NFS and generally enhance ecological health and public recreation opportunities on the Apache-Sitgreaves NFs.

Conveyance of land from the Forest Service to local governments occasionally occurs in the vicinity of urban areas for school or local community purposes. Since 1987, 81 acres have been conveyed to local governments.

Table 131. Land ownership within the boundaries of the Apache-Sitgreaves NFs

Land Ownership	Acres
National Forest System (NFS)	2,018,148
Other (non-NFS)	93,019
Total	**2,111,167**

Table 132. Land ownership adjustments on the Apache-Sitgreaves NFs since 1987

Type of Adjustment	Acres
Land exchanges (acquired)	17,540
Land exchanges (conveyed to private)	4,462
Townsite (conveyed to local government)	81
Purchase/donation (conveyed from private)	215

Over the last several years, owners of private land surrounded by or adjacent to NFS lands have subdivided and sold property as recreation land or home sites. There are areas within the Apache-Sitgreaves NFs, particularly near the urban-forests interface, that may be better suited for private uses because administration is costly to the Forest Service due to the complexity of the adjoining and surrounding land ownership pattern or the permitted use on them. Conversely, some non-Federal (i.e., State, county, private, other) lands within the Apache-Sitgreaves NFs are of a national forest character, and acquisition would reduce ecosystem fragmentation, improve landscape-level management, and eliminate the need to encumber surrounding NFS lands with special use authorizations for roads and utilities.

Since appropriations for lands and interests in land purchases have always been limited and competitive, the donation of non-Federal lands is infrequent, and the authority to sell NFS lands is rare and limited, land exchange continues to be the primary method used for land adjustments on the Apache-Sitgreaves NFs.

The time required to complete land exchanges has increased in response to legal and administrative requirements, thereby increasing costs. With reduced funding, fewer land exchanges can be pursued. Proponents of discretionary land exchanges are required to pay for most, if not all, costs associated with a proposal. Some residents in local communities have voiced opposition to future conveyance of adjacent Federal lands.

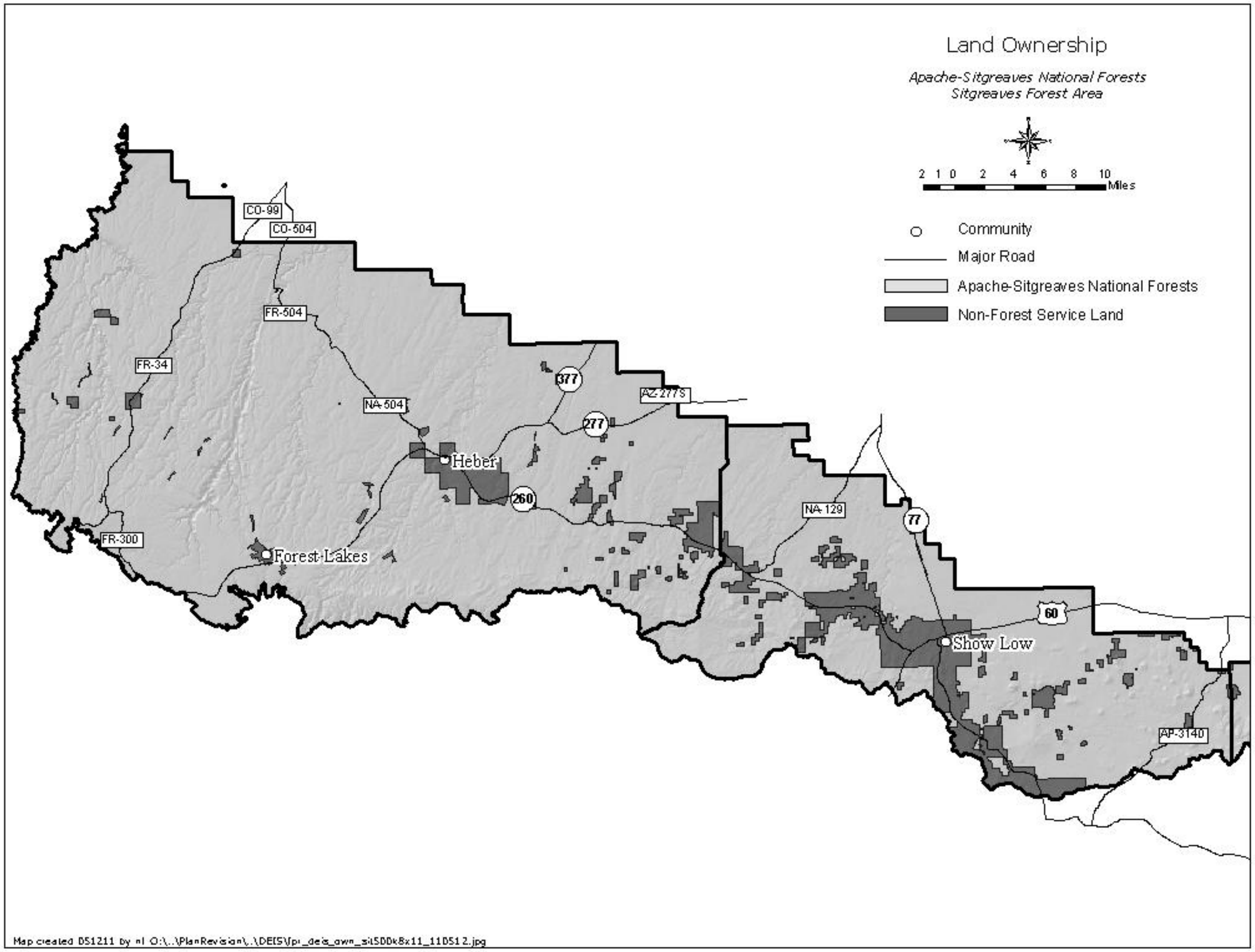

Figure 66. Map of land ownership – Sitgreaves NF

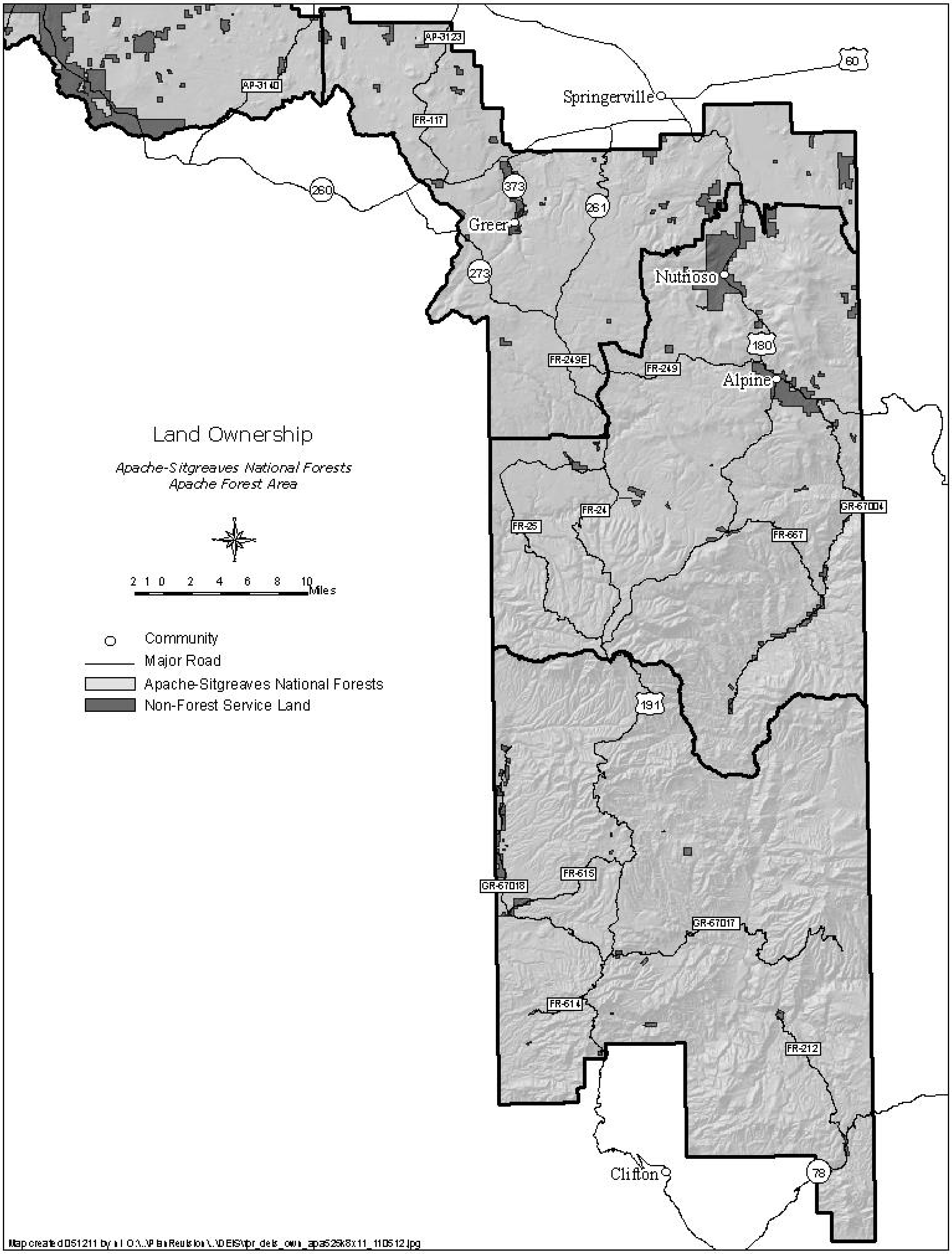

Figure 67. Map of land ownership – Apache NF

Property Boundary Location and Encroachments

The primary purpose of conducting land surveys is to ensure Forest Service activities do not intrude on non-Federal lands and that trespass upon national forests can be prevented and controlled. Most land surveys on the Apache-Sitgreaves NFs were originally done in the late 1800s and early 1900s. Some of these original surveys were proven to be of poor quality. Approximately 365 miles of Apache-Sitgreaves NFs' boundaries have been located since 1987.

Land subdivision and development is increasing the need for accurate and reliable surveys. Numerous conflicts between past surveys have occurred, leading to an unknown number of unauthorized occupancy and use violations on national forest lands. Identification of property boundaries is an increasing expense to resource programs, especially fuels treatments. Increasingly, additional expenditures would be necessary in order to fully utilize national forest resources and to prevent claims against the Federal government. Although land acquisition eliminates the need for posting land line location (i.e., survey boundary) in some areas, many miles of property boundary still need to be surveyed and posted.

Property boundary location involves all activities necessary to identify the boundaries of NFS lands, including the search for survey corners, surveying and marking of land lines, and maintenance of the same. Marking and posting boundaries identifies or locates NFS lands for public use and enjoyment and prevents and controls trespass upon the forests.

More frequent inspections and maintenance of property boundaries in areas where residential developments share common boundaries with the Apache-Sitgreaves NFs continue to be a major component of forest management. Inspection and maintenance of forest boundaries in areas that abut private lands have not kept up with the increases in private land development.

Addressing encroachments on NFS lands contributes to protecting natural resources. Considerable effort may be required to resolve these trespasses upon NFS lands. Most involve simple actions to remove temporary occupancies or activities; while some permanent improvements require other solutions. When discovered, a qualifying innocent trespass is resolved using the Small Tracts Act (16 USC 521c-i). Since 1987, 12 Small Tracts Act cases, involving 36 acres, have been resolved on the Apache-Sitgreaves NFs. Non-qualifying encroachments and unauthorized trespass are resolved through appropriate means, which may include issuance of a special use permit or removal from the Apache-Sitgreaves NFs.

Special Uses

Occupancy and use of NFS lands for public and private purposes through the issuance of special use authorizations and easements continues to be allowed, where the use is consistent with natural resource management goals. Occupancy is defined as taking possession of NFS land and use of the same. Special use authorizations (i.e., special use permits) are used to authorize occupancy and use of NFS lands by Federal, State, and local agencies; private industry; and individuals. Several different public laws regulate activities under special use authorizations. The Organic Act of 1897 and the Federal Land and Policy Management Act (FLPMA) of 1976 authorize the majority of the uses. The Occupancy Permits Act of March 4, 1915, authorizes use and occupancy of NFS land. Special use permits also authorize services (e.g., outfitters, guides) that support the Forest Service mission and meet the needs of the public. Permits are a partnership between the Forest Service and private businesses and individuals to provide services and facilities.

The demand for the use and occupancy of the Apache-Sitgreaves NFs continues to grow, making permit issuance and administration a challenge as staff review and process new and existing authorizations for many uses every year. The NFS land adjacent to private lands is greatly influenced by adjacent landowner or community uses and objectives. In some areas, human activities have altered the natural appearance of these landscapes with the presence of the sights and sounds of people and motorized transportation. Some private lands adjacent to the forests are undergoing residential development.

More people are living close to the Apache-Sitgreaves NFs, and there has been a major increase in development on land adjoining and/or surrounded by the forests. Demands related to this growth include access to the forests, utility corridors, roads, and recreation services. In addition, many urban residents from Phoenix, Tucson, El Paso, and Albuquerque have second homes or recreation residence leases or live in retirement communities surrounded by or adjacent to the Apache-Sitgreaves NFs, and they request access/utilities to support their property. Residents from the large urban areas are some of the primary clients for recreation special use permit holders, such as hunting outfitters and guides. Lands managers are challenged to provide goods, services, and access that populations demand, while meeting a variety of user expectations and desires. The type of requests and proposals for use and occupancy of NFS lands would continue to evolve with technology and imagination.

The expansion of many communities is limited because they are surrounded by the forests and other public lands such as State and Bureau of Land Management. State agencies, counties, local cities and towns, public utilities, and other service providers regularly request use and occupancy of NFS lands to meet needs on non-NFS land. Proponents are asked to exhaust use of lands other than national forest before occupancy of NFS lands is considered. Authorized occupancy often encumbers NFS lands which, in turn, affects management decisions and actions.

In 2011, there were over 450 existing rights-of-way and special use permits for a variety of uses on the Apache-Sitgreaves NFs (table 133). A majority of these are categorized as lands permits (versus recreation permits). As the communities in and around the forests continue to expand, State agencies, counties, local cities and towns, public utilities, and others regularly request new authorizations or amendments to existing authorizations. Increased requests have been received for private access roads across NFS land as residential development has occurred on adjacent private lands.

Table 133. Number and type of special use permits issued on the Apache-Sitgreaves NFs as of April 2011

Special Use	Number of Permits
Recreation	
Non-Commercial Group Use	8
Outfitter/Guide	47
Recreation Residence	25
Recreation Use	18
Lands	
Agricultural Use	2

Special Use	Number of Permits
Cemetery	2
Communication Leases – Broadcast/Non-Broadcast	54
Communication Leases –Facility Managers	3
Construction Camps	4
Electric Transmission and Distribution	9
Federal Aid Highway Rights-of-Way	8
Federal Land Policy and Management Act Easement	20
Federal Land Policy and Management Act Permit	30
Fence	1
Forest Roads and Trails Act Easement	63
Irrigation Water Ditch	10
Manufacturing	2
Mineral Development	11
Mineral Exploration	4
Natural Gas Line	1
Research	33
Reservoir – Dam	16
Sanitary System	12
School	1
Sign	1
Storage	4
Stream Gauging Station	1
Water Conveyance	15
Water Storage Tank	6
Water Transmission	36
Weir	2
Well, Spring, or Windmill	11
Wildlife Water Supply	14
Total	**454**

Energy Corridors and Developments

Energy corridors are a major contribution of the Apache-Sitgreaves NFs to meeting national energy demands. Energy corridors (e.g., above or belowground electric transmission line, gas pipeline) are linear strips of land identified for the present or future location of a utility right-of-way. Other energy developments include the infrastructure associated with the provision or transport of energy (e.g., dams, biomass power generation, wind turbines, solar panels). As population trends increase and electricity consumers demand more reliable power, the demand for energy corridors would increase. Energy corridors extend beyond the boundaries of the Apache-Sitgreaves NFs and are part of the greater western U.S. power grid. There are no energy developments on the forests.

Currently, there are three high-voltage energy corridors located on the forests. Two corridors traverse the Sitgreaves NF, one containing 500 kilovolt (kV) transmission lines (26 miles) and one containing 345 kV transmission lines (27.8 miles). These are operated by Arizona Public Service and Salt River Project, respectively. One 345 kV transmission line, operated by Tucson Electric Power, crosses 12.2 miles of the Clifton Ranger District on the Apache NF. Local distribution and low voltage transmission lines (up to 230 kV) are not considered to be energy corridors.

Existing energy corridors are managed according to approved management plans. Energy corridors are generally not managed to provide recreation opportunities. They are managed for very low scenic integrity where vegetation and structural changes may attract attention and dominate the landscape when viewed from nearby.

The Energy Policy Act of 2005 directed the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior to designate energy transport corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on Federal lands in portions of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. One corridor has been designated for future transmission facilities across the Sitgreaves NF. It was identified in January 2009, by the Secretary of Agriculture’s Record of Decision (ROD) for the Designation of Section 368 Energy Corridors on National Forest System Land in 10 Western States. The 27.8 mile-long corridor across the forests has a width of 3,500 feet and is multimodal (i.e., pipelines and electricity transmission facilities). The existence of this corridor does not authorize any projects, does not mandate that future rights-of-way locate in the corridors, or preclude the Forest Service from denying a project or requiring design revisions. Following site-specific environmental analysis, the Apache-Sitgreaves NFs would expedite, as possible, processing of applications to construct energy-related infrastructure (pipelines, transmission and distribution facilities) within the designated energy corridor.

Communications Sites

There are 34 communications sites on the Apache-Sitgreaves NFs. Twenty-six of the sites are low power and for administrative use—supporting internal Forest Service communications. Eight are commercial sites authorized under a communications site lease. Generally, the leases are long-term commitments of 30 years. Seven of the commercial sites are low power. Porter Mountain communications site is a high power site broadcasting FM radio.

Communications sites provide a variety of services to the general public. Facilities at these sites provide communication for State, county, and city municipalities, and forest administration, including radio antennas, microwave backbones, and wireless services.

Leases are issued to facility owners or managers who may rent space to other users. Associated infrastructure includes roads, power transmission lines, and telephone optic fibers. Lease holders typically need year-round access to service equipment. A list of communications sites is located in appendix C of the proposed plan.

Environmental Consequences of Alternatives

Land Ownership

The potential and opportunity for land exchanges is not expected to vary by alternative. Across **all alternatives**, through the cooperation with other landowners, the forests would emphasize contiguous land ownership and access patterns through consolidation that benefit the private landowner, public, and natural resources. The opportunities for right-of-way acquisition would not change by alternative.

Alternative A would provide criteria and list specific areas for acquisition or exchange which narrows opportunities to work with local communities in addressing their expansion needs and public access to Federal land. Some areas identified for acquisition are no longer relevant.

The **action alternatives** would identify criteria for acquisitions or exchanges without listing specific areas; this would allow the forests to be flexible and to make determinations based on the current needs of both the forests and local communities. There would be management emphasis to work with local communities to understand their community expansion needs, preserve open space and water, and retain access to NFS lands.

The **action alternatives** would encourage cooperation with counties or local communities to identify lands to be excluded from consideration of future land exchanges.

In **all alternatives**, land adjustments (e.g., exchanges, purchases) would consolidate the NFS land base, reduce administrative problems and costs, improve management efficiency for both NFS lands and intermingled private and State lands, enhance public access and use, and support resource management objectives.

Property Boundary Location and Encroachment

Alternative A would provide program direction for maintaining property boundary locations and managing encroachment and trespass on NFS lands.

The **action alternatives** would provide direction to maintain the forests’ boundary by annual survey and posting of the property boundary and would provide specific targets for trespass case resolution. Annual survey and boundary posting objectives would be based on available staffing and funding. Carrying out the objectives would lessen boundary location errors by both the Forest Service employees and community developers. This would also reduce trespass cases.

Special Uses

Alternative A would provide limited direction to respond to or work with adjacent land owners to address their demands. At the time the 1987 plan was written, the population of eastern Arizona (U.S. Census Bureau, 1995) was increasing but not at the current rate. Cities, towns, and communities were not pushing the limits of private or municipal (county) lands and, therefore, not realizing the limitations of available non-Federal land.

The **action alternatives** would recognize the influence of communities on NFS lands and the demand for authorized uses of NFS land. These alternatives would provide standards and guidelines based on meeting desired conditions. The alternatives would manage access from non-NFS development and subdivisions and provide common entry points available to both residents and the general public.

All alternatives would allow the authorization of occupancy and use of NFS land based on public need when services or uses cannot be met on private or other Federal lands. The issuance and administration of special use authorizations would continue to the level allowed by staffing, as directed by policy, law, regulations, and direction. Forest managers would pursue cost recovery to increase the efficiency and quality of services associated with authorizations for occupancy and use of NFS lands.

Authorization of non-Forest Service use on NFS lands may have adverse environmental consequences on some resources (e.g., construction of authorized facilities such as a communications site tower) in the short term and long term. Short-term environmental consequences may include increased human activity such as motorized traffic, noise from construction equipment, temporary roads, and ground disturbance during exploration activities and construction of the authorized facilities.

Long-term environmental consequences may include operation and maintenance of the authorized facilities over the life of the facility. Operation and maintenance activities may include increased human activity and noise, motorized vehicle traffic, or additional ground disturbance. Determination and implementation of mitigation measures and design may lessen environmental consequences.

Over the long term, the greater public and communities should benefit from services that are not provided on non-Federal lands. Authorizations that are a long-term commitment (more than 5 years) and permit some type of construction or ground disturbance or alter the landscape would encumber NFS lands for the term of the authorizations and most likely for the foreseeable future. Few authorized constructed features are fully removed or the landscape is not fully rehabilitated.

Energy Corridors and Development

Alternative A would identify existing energy (utility) corridors and provide limited criteria for authorizing new energy corridors. The **action alternatives** would identify the existing energy corridors in the Energy Corridor Management Area and provide suitability criteria for establishing new energy corridors or other energy developments. Suitability is based primarily on management area type and can be found in chapter 4 of the proposed plan. Differences among the **action alternatives** are based on the acreage of land that could be available for new energy corridors and energy developments (infrastructure) (table 134).

Table 134. Acres suitable for future consideration of new energy corridors or energy developments by alternative

Alternative	Suitable Acres (Percent)	Not Suitable Acres (Percent)
A	NA	NA
B	889,701 (44%)	1,125,651 (56%)
C	1,007,492 (50%)	1,007,860 (50%)
D	784,420 (39%)	1,230,932 (61%)

Alternative C would have the most acres suitable for new energy corridors or other energy developments; while **alternative B** would have slightly less. **Alternative D** would have the least of the **action alternatives**, which reflects the greater acreage in the Recommended Wilderness Management Area. Resources on lands suitable for new energy corridors or developments could be affected if proposals are received and authorized. For example, wildlife could be displaced and their habitats altered. Cultural resources could also be affected by construction, maintenance, and operation of energy corridors and developments through disturbance of sites and increased human use of areas. However, energy corridors or developments on the Apache-Sitgreaves NFs could contribute to national energy needs. Conversely, lands not suitable for new energy corridors or developments would limit potential effects to wildlife, cultural resources, and other resources from these activities. There are no plans to add additional energy corridors or developments. New corridors or developments would be considered on a case-by-case basis and only after the appropriate environmental analysis.

Although not mapped as a separate management area, there is one corridor (see the "Affected Environment" section previously) on the Sitgreaves NF that has been designated for future transmission facilities in **all alternatives**. Applications for transmission lines and distribution facilities in this corridor would be priority for processing. If authorized, there would be similar environmental consequences to those listed above.

Communications Sites

Communications site administration and authorization would continue under **all alternatives**. Consideration of new sites is limited to existing locations in **alternative A**, which would not allow for further expansion or development of new sites in areas that are now being considered by communication providers as new technology is being developed. The **action alternatives** would emphasize locating new sites in existing locations but would also provide suitability guidance when consideration of non-NFS lands is exhausted. The acres of land suitable for new communications sites vary by alternative (table 135). There are no plans to add additional communications sites. New sites would be considered on a case-by-case basis and only after the appropriate environmental analysis.

Table 135. Acres and percent of Apache-Sitgreaves NFs suitable for future consideration of new communications sites

Alternative	Suitable Acres (Percent)	Not Suitable Acres (Percent)
A	NA	NA
B	894,301 (44%)	1,121,051 (56%)
C	1,120,092 (56%)	895,260 (44%)
D	789,019 (39%)	1,226,333 (61%)

Cumulative Environmental Consequences

The cumulative environmental consequences are spatially bounded by an area larger than the Apache-Sitgreaves NFs proclaimed boundary, generally the area immediately adjacent to the forests. Influences on occupancy and use of NFS lands, within the planning period, come from outside of the immediate area. Energy corridors are typically linked in to the western U.S. electrical grid. Land parcels included in adjustment packages are usually outside of the forests' boundary. Communications site and transportation system service areas may include northern and eastern Arizona or the entire State.

Under **all alternatives**, additional transmission lines across the Apache-Sitgreaves NFs would add cumulative environmental consequences by influencing management activities; such as a need for fuels reduction adjacent to the transmission lines, possible wildlife habitat fragmentation, or a change in the scenic integrity objective.

The Centennial West Clean Line would deliver 3,500 megawatts of renewable energy from northeastern New Mexico to communities in southern California and other areas in the West. The clean energy would be transported via an approximately 900-mile overhead, high-voltage direct current transmission line. The transmission line route has not yet been determined, but it could cross the northern portion of the Apache-Sitgreaves NFs (Clean Line Energy Partners, 2011).

Wind power is emerging in Arizona as a viable, stably priced, and local renewable electricity source. The Dry Lake wind plant, located near Snowflake, Arizona, is the first utility-scale project to be built in Arizona. The 63 megawatt project went online in August 2009, sending power to the electric grid. Several other projects are underway and are in various stages of the development process that could result in requests for additional transmission lines across the Apache-Sitgreaves NFs. Under **all alternatives,** options would be limited for placement of new energy corridors and developments on the forests; this could result in proponents pursuing placement on other lands.

Cultural Resources

This section provides an overview of the affected environment and an assessment of the potential impacts each alternative could have to cultural resources on the forests. The potential acres treated within each potential natural vegetation type (PNVT) and the boundary of each management area was used to establish the area of potential effects to cultural resources.

The cultural setting, site types, site distribution, survey information, and public outreach, interpretation, and education can be found in the "Cultural Resources Specialist Report" (Forest Service, 2014e) available in the "Plan Set of Documents."

In the analysis for this resource, assumptions include the following:

- Wildland fire could occur across all NFS lands.
- Management response to a wildfire would be based on direction in the land management plan. Effects to cultural resources would be considered when determining the objectives and management response to a wildfire.
- Under the provisions of the National Historic Preservation Act (NHPA 1966, as amended; 16 USC §470), adverse effects to cultural resources include a variety of criteria affecting the potential eligibility of cultural resources for inclusion on the National Register of Historic Places. Specifically, effects may be deemed adverse according to the following:

  > An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

- Prior to making a project-level decision that is subject to NHPA, the forests would complete cultural resource surveys to locate and evaluate sites for the National Register of Historic Places (NRHP) and analyze the effects of the proposed use or activity in compliance with the First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities among New Mexico Historic Preservation Officer and Arizona State Historic Preservation Officer and Texas State Historic Preservation Officer and Oklahoma State Historic Preservation Officer, and the Advisory Council on Historic Preservation and United States Department of Agriculture Forest Service Region 3 (Southwestern Region programmatic agreement) (Forest Service, 2003). Following the identification and recording of cultural resources, mitigation measures appropriate to the proposed undertaking would be implemented. Such measures would most likely include avoidance of cultural resources by redesigning the project boundaries, modifying construction plans, or excluding site areas from treatments. In cases where specific activities would constitute an adverse effect and avoidance could not be accomplished, the adverse effects would be resolved in accordance with 36 CFR §800.

Affected Environment

Cultural resources represent the tangible and intangible evidence of human behavior and past human occupation. Cultural resources may consist of archaeological sites, historic-age buildings and structures, and traditional use areas and cultural places important to a group's traditional beliefs, religion, or cultural practices. These types of resources are finite and nonrenewable with few exceptions. The lands of the Apache-Sitgreaves NFs contain a long and diverse cultural record that begins approximately 12,000 years ago. Remnants of past and current human activities and events can be found throughout the forests that reflect continuous use by Native peoples and the exploration, settlement, and management by Euro-American cultures. Based on current inventory surveys, it is estimated that over 100,000 cultural resource sites are located on the forests. At present, over 6,900 archaeological sites are recorded in the forests' inventory and site files. Many of these sites are eligible for listing on the NRHP. The heritage program of the Apache-Sitgreaves NFs is responsible for the management of cultural resources for the benefit of the public through preservation, pubic use, and research.

Archaeological Site Types and Distribution

Cultural resources on the forests indicate a long and enduring human presence beginning in the Late Paleoindian (9500 to 6500 B. C.) period. Although most of the lands on the Apache-Sitgreaves NFs have not been surveyed for cultural resources, over 6,900 archaeological sites have been identified within the boundaries of the forests (see figure 68). The archaeological sites associated with this human presence on the forests ranges in size and function. There are 13 primary prehistoric site types (table 136) and several historic site types associated with 8 categories of historic activities (table 137).

The majority of sites in the forests are found between 6,000 and 7,000 feet in elevation. Very few sites are found below 6,000 feet and above 8,000 feet. Corresponding to the 6,000- to 8,000-foot elevations, sites predominantly fall into either the woodlands (38 percent) or the ponderosa pine forests (35 percent).

Table 136. Archaeological prehistoric site types[a]

Type	Description
Low-Density Artifact Scatters	Low-density artifact scatters consist of few artifacts spread over a large area (1 artifact per 10 m^2). These scatters often do not meet the accepted definition for sites and usually lack the potential to provide significant information.
Lithic Scatters	Lithic scatters are artifact scatters containing only flaked and/or ground stone artifacts.
Ceramic Scatters (a.k.a. sherd scatters)	Ceramic scatters contain only ceramic sherds and are the results of activities that require the use of ceramic vessels such as carrying water or storage.
Artifact Scatters	Artifact scatters contain both lithic and ceramic artifacts. These scatters can be the result of activities that require both lithic and ceramic artifacts at resource procurement sites, habitation sites with either ephemeral or buried structures, or by the reuse of sites by individuals with different artifact types at their disposal.
Petroglyphs and Pictographs	Petroglyphs and pictographs are created images found on rock faces, often on rock outcroppings or in rock shelters. Petroglyphs are images pecked, incised, or carved into the rock's surface, while pictographs are painted images.
Water Control Devices	Water control devices such as check dams, grids, and terraces are designed to control the flow of water and/or facilitate the retention of soil moisture for agriculture. These features may or may not be associated with permanent or semipermanent habitation sites or fields.
Shrines	Shrines are usually small circular or rectangular structures, often occurring at high elevation. Artifacts, such as beads or ceramics, are sometimes associated with these features.
Rock Shelters	Rock shelters are natural occurring cavities or overhangs in rock formations that were used by people primarily for habitation. Many rock shelters were used by groups or individuals of several cultural periods and have multiple, successive layers of occupation. Rock shelter sites are a primary source of perishable artifacts such as basketry and textiles normally absent from open air sites.
Pithouse Sites	Pithouse sites are habitation sites that predominantly date prior to A.D. 1000 and may consist of a single pithouse structure or multiple pithouses organized as a village. Pithouse sites range in size, depth, and construction, but they are all structures dug into the ground with a superstructure of wood branches and/or beams and dirt or adobe walls.
Pueblo Sites	Pueblo sites are habitation sites constructed of aboveground masonry that dominate the settlement system after A.D. 1000. Three different types of sites are categorized under the label "pueblo sites": field houses commonly evidenced as a boulder pile over a small area; U-shaped structures with one or two rooms; and pueblos (roomblocks) with four walls consisting of two or more rooms.
Great Kivas	Great kivas are large circular ceremonial structures commonly evidenced on the surface as a circular depression. Great kiva sites may contain this feature type singly or can be associated with a larger pueblo site.
Compounds	Compounds are walled enclosures measuring up to 100 m^2. The function of these sites is unclear, but they often have a very different artifact assemblage from neighboring sites
Defensive Sites	Defensive sites are characterized by defensive walls and locations with restricted access such as a hilltop.

[a] Plog, 1981a, 1981b

Table 137. Historic-age activities and possible site types[a]

Historic Period Activity or Context	Site Types		
Protohistoric (Apache, Yavapai, Navajo) occupation	Temporary camps Fields	Ramadas/shades Sweat lodges	Storage pits Processing pits
Military	Forts Camps	Trails Battlefields	Blazed trees Roads
Settlements	Houses Outhouses Barns	Graveyards Corrals Public buildings	Trading posts
Farming	Homesteads Fields	Irrigation Fence lines	
Sheepherding	Sheep crossings Temporary camps	Sheep dipping vats Sweat houses	Water troughs
Ranching	Ranch houses Barns Corrals	Outhouses Temporary camps Line Shacks	Fence lines
Lumbering (a.k.a. Timber harvesting/Logging)	Camps Landings	Railroad beds Sawmills	
Forest Service and CCC	Cabins Fire towers	Roads Ranger stations	Camps

[a] Plog, 1981a

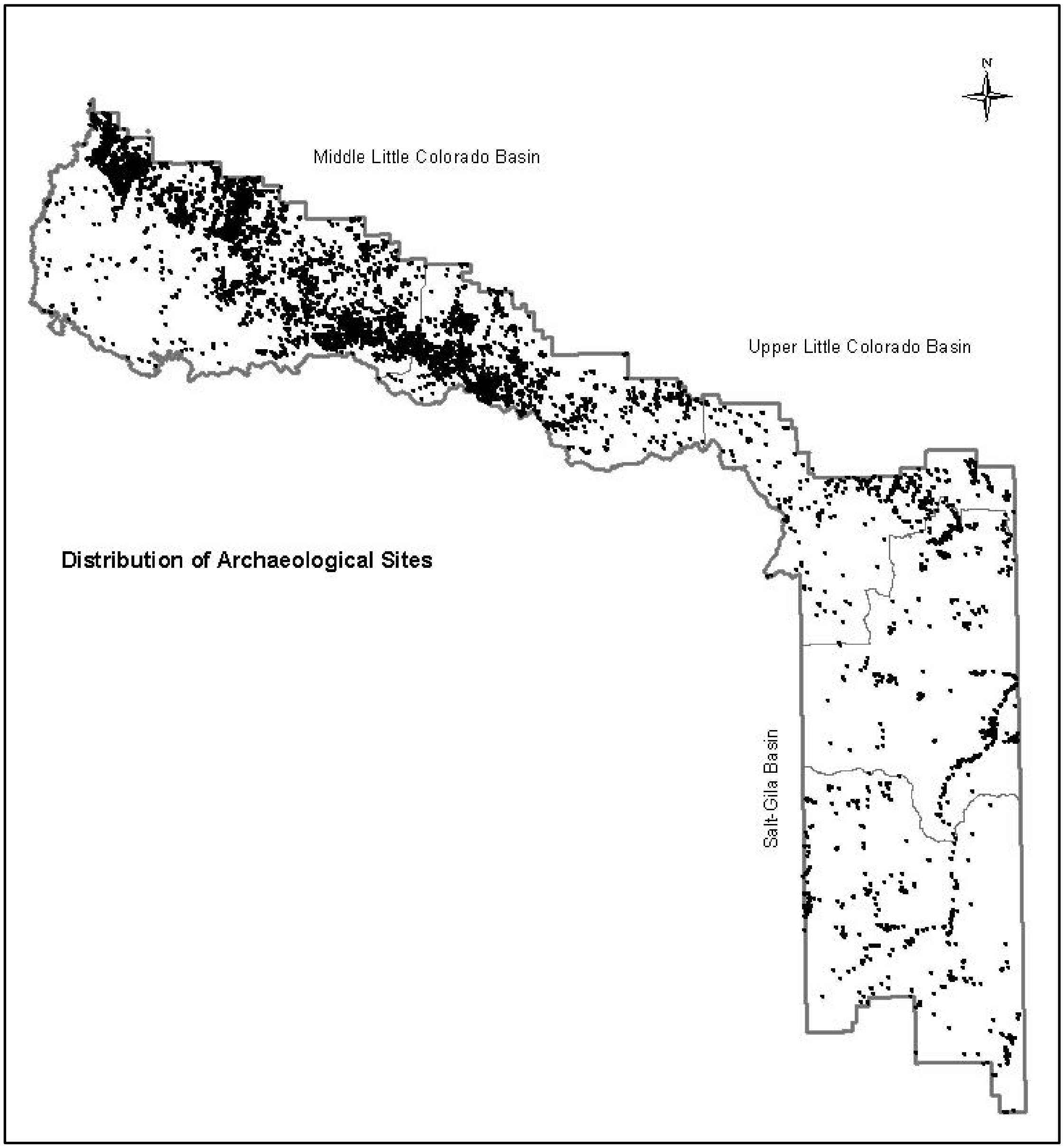

Figure 68. Map of distribution of known archaeological sites on the forests in 2009 (adapted from Donaldson, n.d.)

Apache-Sitgreaves NFs Lands Surveyed for Archaeological Sites

Most of the lands on the Apache-Sitgreaves NFs have not been surveyed for cultural resources. As of 2011, approximately 1,092,000 acres of the forests have been sample surveyed, of which 386,100 acres have been intensively surveyed for cultural resources resulting in the identification of over 6,900 sites. Priorities for comprehensive archaeological surveys include the woodland PNVTs, Chevelon Canyon area, Blue Range Primitive Area, and the San Francisco and Eagle Creek River corridors. Table 138 shows the percent of each PNVT that has been intensively surveyed.

Table 138. Percent of the Apache-Sitgreaves NFs surveyed for archaeological sites by PNVT

PNVT	NFS Acres	NFS Acres Surveyed	Percent of PNVT Intensively surveyed	Identified Sites in PNVT	Number of Surveyed Acres per 1 Site
Cottonwood-Willow Riparian Forest	15,876	3,272	20%	207	96
Dry Mixed Conifer Forest	147,885	24,538	17%	103	430
Great Basin Grassland	185,523	44,769	24%	1,147	60
Interior Chaparral	55,981	1,165	2%	24	83
Madrean Pine-Oak Woodland	394,927	13,631	3%	347	76
Mixed Broadleaf Deciduous Riparian Forest	9,657	607	6%	74	38
Montane Willow Riparian Forest	4,808	1,494	31%	37	55
Montane/Subalpine Grasslands	51,559	7,482	15%	252	241
Piñon-Juniper Woodland	222,166	61,246	28%	2,571	31
Ponderosa Pine Forest	602,206	194,767	32%	2,594	85
Semi-desert Grassland	106,952	5,132	5%	120	98
Spruce-Fir Forest	17,667	278	2%	5	Unknown
Wet Mixed Conifer Forest	177,995	23,981	13%	66	959
Wetland/Cienega Riparian Areas	17,900	2,947	16%	55	Unknown
Totals	**2,011,102**	**385,309**	**19%**	*	**

*Total number of recorded archaeological sites in table does not match total number referenced in text. If sites are located near the boundary of a PNVT, their spatial area may overlay multiple PNVTs resulting in double counting the site when selecting sites in the GIS Cultural Site data layer by PNVT. The data provides relative counts to see differences between PNVTs. The total number of acres surveyed only includes GIS Cultural Survey data for complete/intensive surveys for lands in current Federal ownership. Linear, point, and sample survey areas in the GIS Cultural Survey layer include acres that are completely surveyed but the data was excluded from this analysis because specific spatial data is missing. Total number of sites in PNVT includes sites that were not within complete survey areas.

**Total number of surveyed acres per site is based on sites located within complete survey areas.

National Register Status of Cultural Resources

The National Register of Historic Places (NRHP or National Register) is the official list of historic properties recognized by the Federal government as especially worthy of preservation on the forests for their national, state, or local significance. At present, over 6,900 archaeological sites are recorded. Of those, a minimum of 1,201 sites have been determined eligible for the NRHP. Approximately 170 sites have been determined not eligible for the NRHP. The eligibility status of the remaining sites is unevaluated. According to the R3 programmatic agreement and Forest Service policy, all unevaluated sites are treated as eligible until they are formally determined eligible or not eligible for the NRHP. At present, 10 properties are listed on the NRHP. The following properties or areas are recommended as a priority for nomination to the NRHP (table 139).

Table 139. Properties currently listed and properties that are priority for future nomination to the National Register of Historic Places

Properties Listed on the National Register	Priority Properties for Nomination to the National Register
PS Knoll Lookout	Rudd Creek Rock Art Multiple Property Listing
Bear Mountain Lookout	Roundy Crossing
Lake Mountain Lookout	Black Canyon Rock Shelter
Los Burros Ranger Station	General Crook Trail/Road
Deer Springs Lookout	Prison Point Great Kiva site
Promontory Butte Lookout	Foote Creek Canyon Complex
Pinedale Ranger Station	Blue River Drainage Multiple Property Listing
Water Canyon Administrative Site	Eagle Creek Drainage Multiple Property Listing
Butterfly Lodge[a]	Double Circle Ranch District
Bailey Ruin	Historic XXX Ranch
	Silver Creek Archaeological District (Pottery Hill, Cline Point, Hough's Great Kiva, Cothrun's Great Kiva)
	Logging railroads of the Apache-Sitgreaves NFs
	High elevation ceremonial sites

[a] Under private ownership

Traditional Cultural Properties (TCPs)

Traditional cultural properties (TCPs) are defined in National Register Bulletin 38 as properties associated "with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." TCPs can range from structures, mountains, and other landforms to plant gathering locations to communities. These areas are considered historic properties that may be eligible to the National Register of Historic Places. With regard to the forests, TCPs are most often associated with American Indian cultures. Nine American Indian tribes have ancestral ties to lands within the Apache-Sitgreaves NFs. Forest Service consultations with appropriate members of each tribe can identify the tribe's historic and present day uses of the forests. See the "American Indian Rights and Interests" section for more details.

Five American Indian tribes represented by nine tribal governments are known to have ancestral ties and/or traditional use areas on the Apache-Sitgreaves NFs based on current and past consultation: Fort McDowell Yavapai Nation, Hopi Tribe, Navajo Nation, Pueblo of Zuni, San Carlos Apache Tribe, Tonto Apache Tribe, White Mountain Apache Tribe, Yavapai-Apache Tribe, Yavapai-Prescott Indian Tribe, and the Ramah Chapter House of the Navajo Nation. Forest Service consultations with appropriate members of each tribe can identify the tribe's historic and present-day uses of the forests. See the "American Indian Rights and Interests" section for more details.

The lands, resources, and the archaeological sites within the forests are considered traditionally significant to all affiliated tribes and, in some cases, certain resources or areas are considered sacred to a specific tribe(s). Each group has their own history, traditions, and relationship to the land and to other groups. Traditional use of the forests and its resources by the tribes dates back several generations and, for some groups, many centuries.

Known traditional use areas and cultural places located within the forests include, but are not limited to spruce forests, mountains, cinder cones, springs, caves, trails, and shrines. Among the better known TCPs and sacred sites or areas known to have been used and/or continue to be used for traditional cultural purposes that have been identified in ethnographic reports, archaeological reports, professional papers, and through project-level tribal consultations include, but are not limited to, Escudilla Mountain, Mount Baldy, Greens Peak, Rose Peak, Gobbler Peak, St. Peters Dome, Burro Mountain, Antelope Mountain, Pole Knoll, Flume Mountain SU Knoll, Head of Chevelon Canyon, Chevelon Butte, areas near Aspen Lake, numerous springs, caves, and the Little Colorado River. In some cases there are multiple areas used for collection of resources or religious ceremonies on or within the vicinity of the topographic feature. Many other areas located on the forests are used for traditional cultural purposes, but they have not been specifically identified. Additional areas may be identified through project or permit specific tribal consultation. Therefore, the inventory of known TCPs, sacred sites, and areas used for traditional cultural purposes is subject to change; the list provided here is not comprehensive.

Many of the shrine locations have been adversely impacted by management actions or vandalism (looting) that occurred prior to passing the Antiquities Act of 1906 and the National Historic Preservation Act of 1966. For example, Greens Peak shrine was destroyed by the construction of a fire lookout tower. Rose Peak shrine was severely impacted by the lookout complex. Harris Cave and Bear Cave were looted at the turn of the century. Bead Spring shrine was looted by vandals and damaged by forest management activities. Escudilla Mountain has been impacted by construction of a road and a fire lookout tower. Big Springs has been damaged from recreation and water development. Coon Spring was capped and developed for a city water source.

Many of the shrines have been disturbed or severely damaged which has reduced their potential to yield significant scientific data. Although aspects of their physical integrity have been altered or no longer exist, these locations may still be eligible for the NRHP and have been identified by the tribes as still important in maintaining the traditions and beliefs of their community.

No additional impacts to TCPs from ground disturbance have occurred within Mount Baldy and Bear Wallow Wilderness areas since these areas were designated in 1970 and 1984, respectively.

Current Condition of Archaeological Sites

Past practices, including Forest Service management activities, public resource procurement, recreation use, and natural processes have impacted cultural resources. Multiple uses and activities on the forests that have resulted in the most impacts to cultural resources include infrastructure, livestock grazing, fire, timber and vegetation management, recreation activities, looting and vandalism, and land adjustments (see table 140). A more in-depth description of past effects can be found in the “Cultural Resources Specialist Report” (Forest Service, 2014e) in the “Plan Set of Documents.”

Table 140. Activity effects and the number of sites impacted by activity

Type of Activity	Effects	Number of Sites Impacted[a]
Infrastructure (most roads constructed for timber harvesting)	Displacement, alteration, damage, and destruction of features and artifacts. Compaction.Erosion.	785 (of which 626 sites impacted from NFS roads)
Livestock Grazing	Disturbance by cattle or sheep. Trampling, crushing, compaction. Alteration, damage, and destruction to features. Erosion.	123 (of which 8 sites damaged from tank and pipeline construction)
Fire and Fire-Suppression Activities	Destruction, alteration, and damage to features and artifacts. Refiring, melting, spalling. Erosion.	696
Timber Harvesting (saw timber, pulpwood, firewood)	Displacement, alteration, damage, and destruction to features and artifacts. Removal of artifacts. Erosion.	263
Piñon-Juniper Treatments (pushing and chaining)	Displacement, alteration, damage, and destruction to features and artifacts. Exposure of features and artifacts. Erosion.	75
Recreation Activities	Unintentional vandalism (e.g., clearing features and artifacts from area for camping, reuse of features and masonry for camping activities).	44
Looting and Vandalism	Displacement, alteration, damage, and destruction of features and artifacts. Removal of artifacts.	225
Lands	Transfer to non-Federal ownership. Removal of artifacts, systematic excavation of cultural materials and features.	56

[a] The actual number of impacted sites caused from timber harvesting, piñon-juniper treatments, and looting is higher. The total number of sites impacted in the table only represents a review of 1,908 records and the available site condition data for records in the forests INFRA database.

Environmental Consequences of Alternatives

Treatments that would restore vegetation types to their desired conditions and natural fire regimes would decrease the potential for adverse effects to cultural resources from uncharacteristic high intensity and high severity fires. These treatments would also lead to the restoration of natural processes and the landscape which, in turn, have the potential to restore the historic setting and cultural landscapes of the forests.

Ground-disturbing activities (includes mechanical activities) are the dominant cause of potential adverse impacts to cultural resources in **all alternatives**. The potential types of effects to cultural resources from the proposed treatments in **all alternatives** would be the same. Differences, however, may be found among the alternatives regarding the numbers of cultural resources that would be potentially impacted by the treatments. All the alternatives propose treatments that result in restoring ecosystem health.

National Register Sites and TCPs

The 1987 plan (**alternative A**) has not been amended to reflect the 1992 requirements and amendments to the NHPA. The 1992 amendments clarified Section 110 language terms, and required each Federal agency to establish a historic preservation program. The program must provide for the identification and protection of the agency's historic properties; ensure that such properties are maintained and managed with due consideration for preservation of their historic values; and contain procedures to implement Section 106, which must be consistent with the Advisory Council on Historic Preservation (ACHP) regulations. The 1987 plan also does not address requirements of the Native American Graves Repatriation Act of 1990 (NAGPRA), Executive Order 13007 Indian Sacred Sites, Executive Order 13175 Consultation and Coordination with Indian Tribal Governments, and Executive Order 13287 Preserve America. The focus of management and guidelines for forest resources within the 1987 plan (**alternative A**) were developed prior to the passage or issuance of these statutes which has led to more impacts to historic properties. Emphasis is on use of timber and multiple-use activities that incorporate the location of archaeological sites and TCPs that may not be compatible with those uses. The **action alternatives** have incorporated the passage of these statues and issuance of executive orders providing for increased consideration and management to preserve historic properties for their historic and cultural values.

Under **all alternatives**, the Apache-Sitgreaves NFs would continue to fulfill their responsibilities to conduct non-project related inventory surveys and nominate sites eligible to the NRHP to protect and preserve cultural resources per Section 110 of NHPA, Executive Order 11593, and Section 14 of Archaeological Resource Protection Act of 1979 (ARPA). Internal and outside funding sources, researchers, partners, and volunteers would be sought to assist in research and preservation projects. Public outreach and interpretation would continue to be provided through heritage programs, projects, and interpretive materials. The identification, evaluation, and analysis of the effects from proposed actions to cultural resources eligible, nominated, or listed on the NRHP would be completed to meet the requirements of Section 106 of NHPA.

Although most of the following discussion regarding impacts focuses on effects to archaeological sites, traditional use areas accessed for the collection of traditional materials may also be impacted. See the "American Indian Rights and Interests" section for other environmental consequences associated with TCPs and sacred sites.

Infrastructure

In **all alternatives**, infrastructure would be maintained. The 1987 plan (**alternative A**) only specifies that the Apache-Sitgreaves NFs would comply with NHPA. NHPA requires that adverse impacts are resolved which usually results in the excavation and recovery of the significant and scientific information. Since **alternative A** does not provide suitability standards and guidelines for infrastructure (e.g., roads, communications sites) that address cultural resources and TCPs, more TCPs have been adversely impacted over the life of the plan. The **action alternatives** would result in less potential for adverse effects to cultural resources. Standards and guidelines provide direction for areas (e.g., high site density, on TCPs and sacred sites) not suitable for new infrastructure (e.g., permanent roads, communications sites, power lines). This would increase the potential of the forests to meet the desired conditions for cultural resources by reducing the types of proposed actions that may adversely affect those resources in those locations and reduce the potential of causing additional impacts to TCPs.

Livestock Grazing

In **all alternatives**, livestock grazing would continue. Site-specific actions and the level of permitted use would be determined at the time of the project-level decision. Potential effects from grazing would be the same for **all alternatives** since there would be no change by alternative in the allotments available for livestock grazing. It is recognized that cultural resources have been subjected to grazing for over a hundred years, at levels much higher than current grazing practices, and that some degree of impacts may have already occurred. Livestock grazing can negatively impact sites by trampling, artifact breakage, soil compaction, soil removal, toppling masonry walls, and other types of damage to features as livestock walk through a site. Grazing can indirectly impact sites through loss of ground cover which, in turn, leads to erosion.

Sites sensitive to grazing impacts include, but are not limited to, ruins with free-standing walls, historic structures, and TCPs. In locations where cattle are likely to be attracted to or congregate, rock shelters and rock art sites may also be sensitive sites. The effects on cultural resources would be analyzed by allotment at the project-level. The forests would follow appendix J of the R3 programmatic agreement for rangeland management to meet Section 106 responsibilities. The protocol defines the procedures by which cultural resources (listed, eligible, and unevaluated sites) would be considered in planning and conducting rangeland management activities.

Fire

Non-mechanized treatments include planned (prescribed fire) and unplanned ignitions (wildfire) to address vegetation conditions. In the past, frequent low-intensity fires occurred across the forests. Generally, low-intensity fires have not adversely impacted prehistoric sites that are not fire sensitive or composed of combustible material. Conversely, most historic sites are either combustible or include combustible cultural material.

Under **all alternatives**, the use of wildland fire could result in adverse impacts including historic sites completely burning down; prehistoric rock structures spalling apart from exposure to very high temperatures; ceramic material re-firing; obsidian artifacts melting (caused by high-intensity fire);site features undergoing accelerated erosion because of hydrophobic soils (caused from high intensity and long duration fires); cultural features and structures being displaced or damaged by killed trees falling and uprooting the ground surface; creation of burned stump holes that result in erosion; and cultural materials being exposed to increased erosion and the potential for theft because of vegetation removal from the ground surface.

Suppression responses may adversely affect cultural resources by altering and/or damaging the cultural materials by construction of hand and mechanical control lines that remove, crush, and or displace cultural materials and features. Large and small fire camps may cause effects similar to camping (see following impacts from recreation effects). Some fire retardants may permanently stain the cultural materials.

The use of wildland fire as a management tool for vegetation treatments would have the most potential to affect cultural resources in **alternative D**. **Alternative D** would have the potential to result in a higher amount of acres in the ponderosa pine and piñon-juniper PNVTs affected by mixed severity and high severity (stand replacing) fire to meet desired conditions. Since it emphasizes natural processes (fire), this alternative would have a higher potential for temporary, indirect impacts from erosion and vandalism caused from exposure of cultural materials and features by burning off the vegetation.

Alternative B would have the next highest potential for mixed severity and stand replacement fire. Mixed severity fire effects do not directly equate to sites being permanently altered and damaged. For many sites, the effects from mixed severity fires depend on the site type and the temperature and duration of heat on the ground surface. **Alternative B** would affect more acres by mixed and high severity fire treatments than **alternative C**, potentially resulting in a higher number of cultural resources that could be adversely affected. **Alternative A** would have the least potential for wildland fire treatments to result in high severity that could adversely affect cultural resources. See table 141 below.

Table 141. Annual wildland fire treatments (acres) and estimated fire severity by alternative

Alternative	Low Severity		Mixed Severity		High Severity	
	Low	High	Low	High	Low	High
A[a]	5,038	5,038	1,513	1,513	293	293
B	837	5,859	12,035	35,181	864	2,379
C	566	5,566	2,426	15,737	130	1,284
D	1,748	11,653	15,800	62,905	1,080	3,765

[a] Based on the past 25-year average of wildland fire treatments. No breakdown of burn type available, however, the vast majority (95%) is estimated to be low severity.

Traditional cultural areas used for collecting forest and mineral resources could be affected by the temporary closure of areas from wildfires and treatments. Many of the traditionally used plants respond to fire by increasing productivity. **Alternatives D and B** propose the most acres treated by wildland fire and would potentially increase the long-term productivity of traditionally used forest resources and availability of those resources across the landscape. Access to visiting cultural resources (archaeological sites and TCPs) could be affected in the short term during implementation of prescribed burn treatments.

Conducting prescribed burns has the potential to restore the natural and cultural landscape and the natural fire regime, reducing the potential for permanent adverse effects from high intensity, high severity fires. Mechanized treatments (see the section below on “Vegetation Management”) has similar benefits to cultural resources as wildland fire treatments because they would reduce the potential for permanent adverse effects from fire, but these treatments have the highest potential for long-term indirect effects from erosion caused from intensive ground disturbance near sites. Also, slash from mechanized treatments is often piled burned, resulting in more locations with hydrophobic soils and increasing erosion to sites if the piles were located near sites.

Vegetation Management

Mechanical treatments refer to a variety of possible tools to meet objectives. These include, but are not limited to, hand thinning by chain saws; feller-bunchers to cut trees and lop slash; skidders to move material to landings; bulldozers to push and pile trees and slash; heavy equipment to topple trees over by chaining; and other specialized heavy equipment that can be driven over the ground surface to cut, chop, grind, crush, and lop trees and shrubs. Vegetation is mechanically cleared from areas (landings) approximately ¼ to 1 acre in size with an average of one landing every 20 acres to assist in removing and accessing materials. For a majority of the treatments, the existing road system would be used and maintained with minor reconstruction and maintenance. Some temporary roads may be constructed. Some of the major forest system roads and highways that would be used for access and transportation are historic linear properties that could be or have been determined eligible for the State or National Register of Historic Places (e.g., Forest Road 300, State Highways 77 and 260, U.S. Highway 191).

Under **all alternatives**, mechanical treatments to remove timber could damage or destroy sites through the removal, displacement, breakage, or destruction of cultural materials, features, and structures. Activities that have the potential to result in adverse impacts include, but are not limited to construction of hauling roads and landings, movement of heavy equipment across the ground surface, pushing and crushing and piling harvest material and slash on or across the ground surface, skidding of trees and indirect impacts from overharvesting, which can lead to erosion, and cutting and the removal of historic features (i.e., aspen dendroglyphs, blazed trees, culturally modified/peeled trees).

Alternatives that propose to treat more acres in PNVTs that have a higher density of sites have a higher potential for effects (as listed above). **Alternative A** would have the least amount of potential effects. **Alternative C** would have a higher potential for impacts from ground-disturbing treatments than **alternatives B or D** (table 142).

Table 142. Mechanical treatment objective (acres) and number of sites that could be impacted

Alt. A		Alt. B		Alt. C		Alt. D	
Mechanical Acres	Sites	Mechanical Acres	Sites	Mechanical Acres	Sites	Mechanical Acres	Sites
12,182	115	19,591	260	23,997	256	15,954	224

Management of cultural resources would have the most effect on mechanized treatments in **alternative C**, based on the average number of acres proposed for mechanized treatment for PNVTs with the most sites and the average estimated cost per acre for cultural resource inventories. **Alternative C** would potentially result in the highest cost to the government to complete the potential compliance for cultural resources. The next highest costs would be for **alternative B**, followed by **alternatives D and A**. Table 143 displays the estimated annual average cost to complete 100 percent survey in planned mechanical treatment areas with the highest site density (ponderosa pine forest, Madrean pine-oak and piñon-juniper woodlands, and Great Basin grassland).

Table 143. Estimated average annual cost for cultural resource compliance in proposed mechanical treatment areas by alternative

Alternative A	Alternative B	Alternative C	Alternative D
$243,570	$468,560	$479,220	$372,390

Recreation Activities

Alternative A (1987 plan) would have the most potential to adversely affect cultural resources since the 1987 plan does not provide standards, guidelines, and suitability for motorized and nonmotorized recreation that address cultural resources. This has resulted in more cultural resources being adversely affected over the life of the plan. **Alternative A** would continue to allow motorized cross-country travel. Unrestricted motorized access to remote sites increases the potential for vandalism, including illegal excavation (looting), damage or destruction to standing architecture or rock art, and collection of surface artifacts. Motorized use may remove vegetation that protects and covers archaeological materials. When cultural materials are exposed, the more decorative artifacts and collectable historic objects may disappear through illegal collecting. **Alternative A** would have the least potential to meet the desired conditions for cultural resources.

The **action alternatives** would result in less potential for adverse effects to cultural resources and have a higher potential to move the forests toward the desired conditions for cultural resources. Standards, guidelines, and suitability in the **action alternatives** would provide direction for areas (e.g., high site density, on TCPs and sacred sites) where certain activities (e.g., nonmotorized, mechanized, motorized travel) would not be suitable. These alternatives would eliminate motorized cross-country travel. The potential to disturb cultural resources would be reduced because fewer lands would be open to motor vehicle use, resulting in a beneficial effect to cultural resources. The adverse effects to remote cultural sites from motorized cross-country travel would be reduced and, in some areas, stopped. These **action alternatives** would also place a greater emphasis on the provision of recreation opportunities. This may result in more developed interpretive sites and development of interpretive cultural resource brochures for routes and trails. **Alternative C**, because of the emphasis on developed recreation, would provide the most potential to restore, stabilize, and preserve historic facilities that could be used for public use. For example, historic facilities could be restored and maintained as part of the cabin rental program.

Alternative D would recommend the most acres for wilderness. It would provide the most potential to benefit cultural resources. Protection of wilderness values indirectly protects cultural resources by eliminating certain management activities that have the potential to adversely affect cultural resources (e.g., mechanized treatments and uses, construction of roads and facilities). **Alternatives B and C** would have the next highest potential to benefit cultural resources. Areas recommended for wilderness in both of these alternatives contain cultural resources that are significant at the national level. Managing these areas for wilderness values would have the highest potential to protect these resources and keep them generally free from adverse effects. These alternatives would have the potential to reduce the amount of projects that involve ground disturbance, which would result in reducing the amount of inventory surveys in these areas that would be conducted to identify and evaluate sites for the NRHP. **Alternative A** would not recommend additional wilderness.

Looting and Vandalism

Alternatives B and C, which propose the most acres for mechanized treatments in PNVTs with a higher density of sites, would have the most potential to increase incidents and damage from looting and vandalism. More incidents of looting are found in areas where there is more human activity and accessibility to sites. There would be less risk associated with looting and vandalism in **alternatives A and D**.

Lands

All alternatives would have the same potential to impact cultural resources from land adjustments. Land adjustments have the potential to adversely affect the use and characteristics of cultural resources. Conveying cultural resources that are eligible or listed on the National Register out of Federal ownership is an adverse effect. The resources would no longer be protected and managed under Federal laws and regulations and Forest Service policy.

Exchanges of Federal lands may affect and/or prevent the access and use of traditional cultural properties (TCP) by American Indian tribes. Once the lands are transferred out of Federal ownership, the tribes would not be guaranteed the same rights of access and use of the TCP or area for traditional purposes. Federal laws, executive orders, regulations, and Forest Service policy regarding American Indian rights and interests would no longer apply.

Land adjustments may also potentially have a positive effect on cultural resources. Cultural resources on acquired private lands would come under protection of Federal laws and management. Acquired private lands, including TCPs that were previously inaccessible to tribes, would be accessible for traditional proposes. No specific areas for acquisition or exchange are proposed. Site-specific analysis would be completed at the time a proposal is under consideration.

Cumulative Environmental Consequences

Federal, State, and tribal lands adjacent to the Apache-Sitgreaves NFs compose the cumulative effects analysis area for cultural resources. Many recorded sites on the forests are at least regionally significant and some are nationally significant. This regional or national importance of some sites within the forests reinforces the need for protecting significant local cultural resources that may be affected from cumulative impacts of management activities within the forests and region.

Current and previous Forest Service management activities, recreation, general public uses, and natural processes have impacted cultural resources. Multiple archaeological sites would be adversely affected by the improvement and realignment work on U.S. Highway 60 Silverking to Superior. Improvement to SR 77 may have additional adverse effects to prehistoric archaeological sites. Several land exchanges that involve forest lands (including transfer out of NFS ownership) may lead to adverse effects to multiple archaeological sites and one known TCP. Most of these sites would require data recovery (excavation) to resolve adverse effects. Data recovery involves the scientific recovery of significant information through destructive methods The Coconino and Kaibab NFs have completed a draft environmental impact statement for the Four Forest Restoration Initiative (4FRI). The proposed action involves landscape-scale vegetation treatments using mechanized vegetation removal and wildland fire. This proposed action is expected to result in no adverse effects to cultural resources and reduce the potential for permanent adverse effects from uncharacteristic high intensity and high severity fires. Inventory surveys that would be conducted for 4FRI would result in recording archaeological sites and TCPs and allow for better management of cultural resources and increasing scientific knowledge. Passports in Time (PIT) projects are being conducted. Under **all alternatives**, implementation of the proposed treatments for 4FRI and future Apache-Sitgreaves NFs vegetation treatments would result in a beneficial cumulative impact to cultural resources by increasing the amount of acres surveyed for cultural resources and reducing the potential adverse effects from uncharacteristic wildfires.

American Indian Rights and Interests

The American Indian Religious Freedom Act declares that the policies of the U.S. shall preserve and protect the American Indian's freedom to practice their religion. This includes the right to have access to religious sites, to use and retain sacred objects, and to conduct ceremonials and practice traditional rites on the forests. The Religious Freedom Restoration Act states that the government shall not substantially burden a person's exercise of religion even if the burden results from a rule of general applicability, except when the government demonstrates that application of the burden to the person is in furtherance of a compelling governmental interest.

This section includes a review of the current conditions and an assessment of the potential impacts each alternative could have on tribal access and use of the forests. The area of potential effect includes the lands and resources of the Apache-Sitgreaves NFs and the potential effect to tribal resources and/or rights within lands adjacent to the forests. The full analysis for American Indian rights and interests can be found in the "American Indian Rights and Interests Specialist Report" (Forest Service, 2014b) available in the "Plan Set of Documents."

To determine how the alternatives would affect the use and access to religious sites (1) an inventory of the known traditional cultural properties (TCPs) and sacred sites were identified through known and accessible ethnographic reports, archaeological reports, and tribal consultation responses; (2) a review of past and current accommodations to tribes to access and use TCPs, sacred sites, and resources for ceremonial purposes was completed; and (3) a review of known existing tribal rights was conducted to determine how the alternatives could potentially affect tribal rights.

In the analysis for this resource, assumptions include the following:

- Members of American Indian tribes would continue to access, use, and/or conduct religious pilgrimages and ceremonies at known TCPs and sacred sites and collect forest and botanical resources.
- The lands and resources of the Apache-Sitgreaves NFs used by American Indian tribes for traditional cultural purposes and traditional use will not be used for commercial use.
- Prior to making a project-level decision that is subject to National Historic Preservation Act (NHPA), the forests will consult tribes to identify TCPs and sacred sites, evaluate TCPs for the National Register of Historic Places (NRHP), and analyze the effects of the proposed use or activity in compliance with the First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities among New Mexico Historic Preservation Officer and Arizona State Historic Preservation Officer and Texas State Historic Preservation Officer and Oklahoma State Historic Preservation Officer, and the Advisory Council on Historic Preservation and United States Department of Agriculture Forest Service Region 3 (Southwestern Region programmatic agreement) (Forest Service, 2003) and/or memorandum of understandings with tribes. Following the identification and recording of TCPs, mitigation measures appropriate to the proposed undertaking will be implemented. Measures will be determined through consultation. Most likely they will include avoidance by redesigning the project boundaries and/or changing the time/season of when the project is implemented. In cases where specific activities would constitute an adverse effect and avoidance cannot be accomplished, the adverse effects will be resolved in accordance with 36 CFR § 800.

Affected Environment

Five American Indian tribes represented by nine separate tribal governments have cultural ties to lands within the Apache-Sitgreaves NFs. Forest Service consultations with appropriate members of each tribe can identify the tribe's historic and present day traditional uses and sacred sites of the area. The lands, resources, and the archaeological sites within the forests are considered traditionally significant to all affiliated tribes and, in some cases, certain resources or areas are considered sacred to one or more. TCPs may be eligible to the NRHP because of their association with cultural practices and beliefs rooted in history and their importance in maintaining the cultural identity of ongoing American Indian communities. The following five American Indian tribes are known to have ties to the forests: Hopi, Navajo, Western Apache (San Carlos, Tonto, and White Mountain), Yavapai, and Zuni.

Each group has their own history, traditions, and relationship to the land and to other groups. Traditional use of forest lands and their resources by the tribes dates back several generations and, for some groups, many centuries. The tribes are discussed in alphabetical order.

Hopi

The Hopi are a northern Uto-Aztecan-speaking people that reside in 12 villages on 3 mesas along the southern border of the larger Black Mesa in northeastern Arizona. The traditional Hopi land (*Tutsqwa*) covers an area far greater than the current reservation. It extends west to the Middle Verde River Valley, to the Bill Williams Mountains, and to the Grand Canyon (Senior, 2005). Traditional Hopi migration histories extend well beyond this heartland, however, and the Hopi used resources, trails, and maintained trading relationships well beyond the boundaries of *Tutsqwa* (Ferguson and Dongoske, 1994). Origin stories suggest that the current Hopi are a combination of peoples (clans) who arrived at the current Hopi villages from many directions. According to Hopi traditions, migration paths from their emergence ranged west to California, south to Mexico and east to the Rio Grande Valley. There was also a series of migrations from the San Juan region to the Black Mesa area of Arizona. Eventually, these migrations took the Hopi ancestors across the Southwest until they arrived at their place on the Hopi Mesas (Courlander, 1971). Through previous project consultations the Hopi have identified 13 clans as being associated with Apache-Sitgreaves NFs: Badger, Sand, Corn, Tobacco, Water, Sun, Parrot, Katisina, Crow, Lizard, Butterfly, Bear, and Eagle.

Hopi traditions of preservation and protection of sacred sites and subsistence-gathering areas are important and vital to the Hopi way of life. Many archaeological sites affiliated with the Cibola Anasazi and Mogollon archaeological cultures are located on the forests. The Hopi claim affiliation to these cultural groups. Preservation of archaeological sites is a key religious value to the Hopi. Each of the places that the Hopi ancestors stopped during their migration is considered TCPs by the contemporary Hopi and is remembered in their songs and stories. Because Hopi religion has its foundation in the emergence and migration stories, and because archaeological sites are interpreted by the Hopi as a part of this foundation, archaeological materials throughout Arizona are very important to the Hopi (Senior, 2003). The Hopi homeland and traditional use area encompasses the west half of the Black Mesa Ranger District. The Hopi homeland includes shrines, sacred natural features, eagle trapping locations, and regions where salt is collected (Ellis, 1974). The Apache-Sitgreaves NFs were also part of the Hopi hunting and plant collection area. The Hopi have traditionally gathered spruce boughs, snakes, eagles, tobacco (*Nicotiana attenuata*, *Nicotiana trigonophylla*), Indian tea (*Theleperma megapotamicum*), grasses, and other natural resources within the Apache-Sitgreaves NFs. The Hopi have noted that they shared lands with the Zuni in historic and pre-contact times (Senior, 2005). At present, the Hopi have identified Chevelon Butte and Chevelon Cliffs as sacred sites and archaeological sites as TCPs.

Navajo (Din'e)

The boundary of the traditional Navajo homeland is symbolized by their four sacred mountains, although the aboriginal use area extends beyond these markers. The sacred mountains are Blanca Peak (*Sis Naajinii*) near Alamosa, Colorado; Mount Taylor (*Tsoo Dzil*) near Grants, New Mexico; the San Francisco Peaks (*Dook'o'oosliid*) near Flagstaff, Arizona; and the La Plata Mountains (*Dibe Ntasaa*) near Durango, Colorado (BOR, 1995). The Navajo are one of the Apachean tribes who are linguistically tied to the Southern Athapaskans who migrated from the north into the American Southwest between A.D. 1000 and 1500. They were a nomadic hunting and gathering people who lived in small, scattered bands. They raided and traded with the Spanish and Pueblo peoples (Grahame and Sisk, 2002). Historical accounts support that the Navajo were established in northeastern Arizona in the 1600s. By the mid-1800s they were practicing a lifestyle of farming and grazing livestock, in addition to their nomadic methods of subsistence.

Very little physical evidence of the Navajo presence has been recorded on the forests. Historically, the Navajo are known to have traded with the Yavapai; traditional routes may be present on the forests. During the Fort Sumner period, the Navajo were living (hiding out) in Chevelon Canyon, in the vicinity of Potato Wash, and Escudilla Mountain (Senior, 2005). The earliest physical evidence of Navajo use of the area dates from the 1920s and 1930s when Navajos were employed in the timber industry. The Navajo have identified Escudilla Mountain, Chevelon Butte, and the Little Colorado River as sacred places (Vannette and Fearey, 1981; Senior, 2005). The Navajo also consider any remaining sweat lodges on the forests to be TCPs. All springs and natural water sources are significant places and especially valued by the Navajo (Senior, 2005).

Western Apache (Indé)

The Western Apache comprise the Cibeque, the San Carlos, the Tonto (*Dil zhéé*), and the White Mountain Apache tribes. The Western Apache territory is bounded on the east by the Pinaleno Mountains, on the south by the Salt River, along the north by the upper Verde Valley and Flagstaff, and along the west by the Mazatzal Mountains. Linguistically, the Western Apache (*Indé*) are tied to Southern Athapaskan speakers who migrated from the north and arrived in the American Southwest between A.D. 1000 and 1500 (as summarized by Basso, 1983 and Perry, 1991). Traditional creation beliefs of the *Indé*, however, are firmly rooted in the mountains of the Southwest (Sine, 1988 as quoted in Hilpert, 1996). Important *Indé* ceremonial beings, who figured prominently in their creation stories, the *Gán* (also *Gaan*), are associated with Southwestern mountains, peaks, and especially caves where they gain access to the spirit world under the mountains. The Western Apache identify the essence of *Indé* culture and virtue with mountains and their traditional lands, and this is most often associated with morals of stories tied to specific named places (Basso, 1996 and 1997; Hilpert, 1996).

Originally, the Western Apache practiced a nomadic hunting and gathering way of life. By the 1600s they had also adopted farming in the spring and summer and a seasonal cycle of food gathering (Grahame and Sisk, 2002). After the introduction and contact with Spanish livestock and horses, the Apaches adapted their way of life to include raiding the Spanish and other tribes for livestock and food. The traditional nomadic way of life of the Western Apache was exterminated when the current reservations were established in 1874 after the Western Indian wars with the U.S. government. Only the White Mountain Apache were located in a portion of their traditional homeland and were near the sacred mountains which are the deepest sources of Apache identity and culture (Grahame and Sisk, 2002). Since many of the Apachean artifacts were made of perishable materials, they are rare and most date to historic times. Apachean sites have been recorded on the forests. The forests are encompassed within the traditional subsistence use area of the Western Apache. Plants and trees traditionally used by the Apache include, but are not limited to, mescal agave (*Agave parryi*), yucca, piñon nuts, acorns (Emory oak), bear grass, aspen, reeds, and cattails. Mount Baldy and Escudilla Mountain have been identified as specific Apache sacred places on the Apache-Sitgreaves NFs.

Yavapai

Yavapai have stated that their people have been here in Arizona since time immemorial and that they were the first true Arizonans. The boundary of the of the Yavapai territory ranged from the San Francisco Peaks, to the area occupied by the modern communities of Williams and Ash Fork, to the area north of the Santa Maria and Bill Williams Rivers; it then continued west to the mountains and sometimes the lowlands along the Colorado River as far south as Yuma, then south along the Gila River to the Pinal Mountains, and then east along Tonto Creek up thorough the Superstition Mountains to the Mogollon Rim (Khera and Mariella, 1983, p. 38). Linguistically, the Yavapai are part of the Upland Yuman language, which the Hualapai and Havasupai are the other two other major dialects. Some researchers believe the Yavapai were part of the Yuman migration from the West into Arizona after A.D. 1100; while others believe the Yavapai are the descendants of the southern Sinagua people. The Yavapai primarily practiced a seasonal hunting and gathering lifestyle and some agriculture (Khera and Mariella, 1983). Historically, they are known to have traded with the Apache, Navajo, and Hopi. Traditional trading routes may be located within the forests. The Yavapai had a closer relationship with the Western Apache and some intermarriage took place. Plants and animals that were traditionally hunted and gathered by the Yavapai are found within the Apache-Sitgreaves NFs. Presently the Yavapai have not specifically identified areas or places of traditional and/or of religious significance on the Apache-Sitgreaves NFs (Senior, 2005).

Zuni

The Zuni reservation is in west-central New Mexico and eastern Arizona, with the population and cultural center at Zuni Pueblo in New Mexico. The Zuni traditional homeland encompasses an area stretching from the Grand Canyon and San Francisco Peaks in Arizona, to the Abajo Mountains in Utah and Colorado, to the Sandia Mountains near Albuquerque, New Mexico, and the Mogollon, Gallo, and Tularosa Mountains in New Mexico (NAU and SWCA, 1996).

Zuni origin stories relate how the Zuni people were created in the Fourth World and emerged into the Fifth World (this world) from a location in a side canyon along the Colorado River in Grand Canyon. From there, the people began their migrations, stopping at numerous places along the way (NAU and SWCA, 1996). During this time the people split into four groups. One group headed north to Chaco Canyon, a second group went northeast up the Zuni River, a third southeast toward the White Mountains, and the fourth group went south, never to be heard from again. The first three groups rejoined at *Halona:Iti-wana*, the Middle Place, today known as Zuni Pueblo (Ferguson, 2007).

During their migrations through most of Arizona and New Mexico, the Zuni established many homes, camps, trails, shrines, and burial grounds. The Zuni claim cultural affiliations with the archaeological sites identified with the Cibola Anasazi and Mogollon archaeological cultures located on the forests. Zunis claim affiliation to these cultural groups. To the Zuni, these migration-related sites are imbued with life and spiritual forces that continue to be important to the Zuni people through their religion.

The Zuni consider their traditional homeland to be all the places that their ancestors traveled to and visited. Each of the places that the Zuni ancestors stopped during their migration is considered sacred by the contemporary Zuni and are remembered in their prayers and still visited by the Zuni people. Shrines are actively maintained by a select group of Zuni. As of 1846 the Zuni had placed war god shrines along the Mogollon Rim to protect the Zuni area. A Zuni watch tower on the rim was located in the late 1800s near the town of Springerville (Senior, 2005). The Mogollon Rim was a natural boundary between the Zuni and the Apache. Trails used by the Zunis also hold religious importance and are cared for through blessings and prayers. The forests are encompassed within the Zuni traditional mineral, hunting, and religious use areas and are within the Zuni traditional homeland. The Zuni are known to have collected spruce pollen and aspen wood for religious purposes and numerous other plants for subsistence and medicinal use. Numerous Zuni TCPs and sacred sites are located on the forests; including Escudilla Mountain, Mount Baldy, and springs (Zuni Cultural Advisory Team, 2011; Ferguson, 2007, 1981, and 1980; Senior, 2005).

Traditional Cultural Properties and Sacred Sites

As discussed above there are known TCPs and sacred sites located within the forests. A TCP and a sacred site are not necessarily mutually exclusive of each other. A TCP must meet the definition and criteria for the NRHP, where as a sacred site is identified by the tribe as defined in Executive Order 13007 and does not need to meet the definition and criteria for the NRHP. American Indian tribes do not make a distinction between the two. Laws and executive orders define the two separately which results in differences in how land management agencies are required to consider their effects and resolve those effects from management actions.

TCPs and sacred sites include, but are not limited to, spruce forests, mountains, cinder cones, springs, caves, trails, and shrines. These places are used for activities that include, but are not limited to, collection of plants, boughs, aspen trees, teepee poles, pigments, feathers, pollen, hunting, religious pilgrimages, accessing springs, and making special offerings. These places are ethnographically important to tribal values and are inseparable from their cultures. Multiple areas are used for collection of resources or religious ceremonies on or within the vicinity of the topographic feature. Many other areas located on the forests are used for traditional cultural purposes but have not been specifically identified. See the “Cultural Resources” section for a listing of known TCPs and a description of past impacts to TCPs and sacred sites.

Tribal Rights

The Supreme Court has recognized that when American Indian reservations were established, the Federal government reserved enough water necessary to make the reservations livable. Reservations for tribes culturally affiliated with the forests were created by executive orders. Several water resources are located on and across the forests that are connected to tribal water rights. The San Carlos Apache Nation has existing senior water rights to the Salt River Basin that includes the Salt, Gila, and Black Rivers. The Pueblo of Zuni has existing surface and underground water rights to the Little Colorado River. The Navajo Nation and Hopi Tribe claim water rights to the Little Colorado River. Their water rights would be determined by the Little Colorado River Adjudication negotiation settlement. The Little Colorado River Adjudication involves the Lower and Upper Little Colorado River and Silver Creek. The San Carlos Apache Tribe and Tonto Apache Tribe claim water rights to the Gila River tributaries which have not been resolved.

Water quality and rights are under the legal jurisdiction of the State of Arizona. Forest management has not impacted tribal water rights. Additional information on water use trends and water rights can be found in the “Water” section.

Environmental Consequences of Alternatives

The Apache-Sitgreaves NFs consult with nine different tribal governments and one chapter of the Navajo Nation that have a cultural affiliation to the area (see the “Cultural Resources” section). At present, tribes have not identified concerns or issues that the proposed plan and alternatives would result in adverse impacts to known and unidentified TCPs and sacred sites or the use of those locations. The tribes have expressed interest on the affects to wildlife (eagles), effects of land adjustments and mining, and the need to prevent additional adverse impacts from activities to TCPs and sacred sites. Some tribes may not reveal specific locations of traditional use of sacred sites to non-practitioners because of cultural restrictions and/or religious beliefs unless that location is at risk of being adversely impacted by project activities. Government-to-government consultation about projects and activities would continue between the Apache-Sitgreaves NFs and the tribes. If tribal consultation results in identification of additional, currently unknown, traditional uses and traditional cultural properties, impacts to those areas would be considered during project-specific environmental assessments.

Traditional Cultural Properties and Sacred Sites

The 1987 plan (**alternative A**) has not been amended to reflect the 1992 requirements and amendments to the NHPA. The 1992 amendment Section 101(d)(6) states that properties of traditional religious and cultural importance to an Indian tribe may be determined eligible for inclusion on the National Register. It also states a Federal agency shall consult with any Indian tribe that attaches religious and cultural significance to these properties. Also, the 1987 plan has not been amended to address the requirements of the Native American Graves Repatriation Act of 1990 (NAGPRA), Executive Order 13007 Indian Sacred Sites, Executive Order 13175 Consultation and Coordination with Indian Tribal governments nor the 2008 Farm Bill. In all of the **action alternatives,** the plan would incorporate the passage of these statues and issuance of executive orders.

Alternative A only specifies that the Apache-Sitgreaves NFs would comply with the NHPA. NHPA requires that adverse impacts to eligible or listed cultural resources are resolved which usually results in the excavation and recovery of the significant and scientific information. Sacred sites inherently do not possess physical scientific information that can be resolved or recovered prior to being adversely impacted. Since the 1987 plan does not provide suitability standards and guidelines that address TCPs or sacred sites, TCPs and sacred sites have been adversely impacted over the life of the plan. Activities that limit or change the use and access of traditionally used resources, TCPs, or sacred sites would have adverse effects by altering or removing a specific traditionally used resource or impacts the process and/or continuation of the ceremonial rite.

Actions that have or may alter or damage the physical integrity of a location, setting, or resource for traditional purposes include, but are not limited to recreation improvements installed adjacent to a “shrine” that changes the setting and increases public visitation and vandalism (e.g., collecting artifact offerings, moving stones, constructed improvements); communication and lookout facilities constructed within the TCPs or sacred site that alters, damages or destroys the physically constructed features; creating visual and physical intrusions (i.e., communication tower) that alters, damages, or destroys the attributes of the place that are necessary for the traditional religious use or cultural purposes; recreation special use permits to allow uses of TCPs/sacred sites that may conflict with the traditional use (e.g., tribal members go to conduct a ceremony at the same time a permitted group of people and motorized vehicles are parked and using the TCP/sacred site, thus changing the setting and privacy necessary to conduct the ceremony); and constructing, rerouting or decommissioning trails (motorized and nonmotorized), roads and highways that alters, damages, or destroys the traditional access and use of TCPs/sacred sites.

Motorized cross-country travel would be allowed across the forests except for areas where it is prohibited or not authorized (e.g., wilderness, wildlife quiet areas). This may result in adverse effects to TCPs/sacred sites in areas not restricted from motorized cross-country use. The associated sound and physical disturbance could alter, damage, or destroy the use of a TCP/sacred site. Unrestricted motorized access to remote TCPs/sacred sites would increase the potential for vandalism, including illegal excavation (looting), damage or destruction to standing architecture (shrines) or rock art, and collection of surface artifacts (offerings, beads, turquoise, pottery). Motorized use may remove vegetation that protects and covers the cultural materials. When cultural materials are exposed, the more decorative artifacts and collectable historic objects may disappear through illegal collecting. Nonmotorized trails that are constructed or converted from roads that are located on or adjacent to TCPs/sacred sites have the same potential to physically affect the use of TCPs/sacred sites by increasing the potential for vandalism and collecting offerings.

The **action alternatives** would result in less potential of adverse effects. Standards, guidelines, and suitability would provide direction that certain areas with TCPs or sacred sites are not suitable for new infrastructure (e.g., permanent roads, communications sites, power lines) and recreation activities (i.e., motorized travel). This would increase the potential of the forests to meet the desired conditions for American Indian Rights and Interests by reducing the type of projects and activities that may adversely affect those resources in those locations and reduce the potential of causing additional impacts to TCPs and sacred sites. These alternatives would eliminate motorized cross-country travel. The potential to disturb TCPs/sacred sites would be reduced because fewer lands would be open to motor vehicle use, resulting in a beneficial effect to TCPs/sacred sites. The adverse effects (see above) to remote TCPs/sacred sites from motorized cross-country travel would be reduced and, in some areas, stopped. The management direction in the **action alternatives** for suitable and unsuitable uses in areas with TCPs/sacred sites would not completely eliminate the potential effect to TCPs/sacred sites. If a future proposed project-specific action was located in an unsuitable area or is an unsuitable activity, the forest plan could be amended at the time of the analysis and a decision to authorize that project action could occur.

Alternative D would recommend the most acres for wilderness. This alternative would provide the most potential to benefit TCPs and sacred sites. Protection of wilderness values indirectly protects use of TCPs/sacred sites by eliminating certain management activities that have the potential to adversely affect them (e.g., mechanized treatments and uses, construction of roads and facilities). Mount Baldy and Escudilla Mountain are both in designated wilderness areas. **Alternatives B and C** would have the next highest potential to benefit TCPs/sacred sites because areas recommended for wilderness in both of these alternatives contain TCPs that could also be sacred sites. Managing these areas for wilderness values would have the highest potential to protect these resources and keep them generally free from adverse effects. **Alternative A** would not recommend additional wilderness.

Tribal Rights

The proposed treatments in **all alternatives** would provide for sustainability and improvement of wildlife habitat. The alternatives are not expected to reduce or limit the long-term availability and use of traditionally used wildlife. The tribes have not identified any concerns that the proposed treatments would affect their access and use of traditionally used forest products and minerals. The alternatives do not propose treatments that would reduce surface waters or pumping of groundwater. Special use permits that would affect surface waters and pumping of groundwater that could affect tribal water rights would be analyzed at the project-level prior to a decision.

Cumulative Environmental Consequences

The cumulative effects analysis area consists of lands that include American Indian TCPs and sacred sites within the State of Arizona that are associated with tribes culturally affiliated with the lands of the Apache-Sitgreaves NFs.

Tribes view TCPs and sacred sites that are part of their traditions as interconnected places/features of the religious and traditional landscape. Effects to these places or features may directly or indirectly affect the access and use by the tribes to conduct ceremonial and/or traditional practices of other sacred sites or TCPs that are part of their traditions. Current and previous Forest Service management activities, public resource procurement and recreation use, and natural processes have impacted TCPs and sacred sites. At present, there are several known activities, projects, or planned projects and/or plans located on lands that have or would adversely affect TCPs and sacred sites.

Recently, the Coconino NF has approved snow making and the expansion of the infrastructure of the existing Snowbowl Ski Area. This action has been determined to have a significant adverse effect to the San Francisco Peaks as a TCP and a sacred site. Congress is considering a land exchange proposal to transfer lands on the Tonto NF that includes Oak Flat, Gaan Canyon, and Apache Leap to Resolution Copper Company. The Tonto NF has also recently approved exploratory mining in these areas. Oak Flat, Gaan Canyon, and Apache Leap are sacred sites of the Western Apache. A land exchange would have an adverse effect to these sacred sites. The San Carlos Apache are opposed to the exploratory drilling. The Apache have stated that mining in these locations would have an adverse effect to these places. The Apache-Sitgreaves NFs is considering a proposed action to sell a tract of land that includes a TCP associated with the Zuni and Hopi. The specific location has been recently identified by the White Mountain Apache as a sacred place. Existing permitted activities or facilities that are located on TCPs and or sacred sites on the national forests within Arizona are expected to continue.

The Hopi Tribe, San Carlos Apache Tribe, and Pueblo of Zuni have verbally stated to the Apache-Sitgreaves NFs during consultation meetings and through letters to the Secretary of Agriculture that the Forest Service is incrementally damaging or destroying TCPs and sacred sites that are important and vital to maintain the physical and spiritual survival of the tribes. Sacred sites are interconnected and are part of the spiritual and traditional landscape. Although **alternative A** and the **action alternatives** are not expected to have a cumulative adverse impact to American Rights and Interests, potential mining activities, congressional actions, and Apache-Sitgreaves NFs' authorized land adjustments could have the potential to contribute to cumulative adverse effects.

Forest Products

This section provides an estimate of lands suitable for timber production, cutting levels in relation to long-term sustained yield capacity (LTSYC), and allowable sale quantity (ASQ) volume for the next five decades. The wood products volumes that could be removed from lands both suitable and not suitable for timber production are estimated. It also examines how the plan alternatives contribute to local communities through the availability of wood and tree products. The full analysis, including all assumptions and methodology, for this resource can be found in the "Forest Products Specialist Report" (Forest Service, 2014i) available in the "Plan Set of Documents."

The wood products that could be removed from ponderosa pine, dry mixed conifer, wet mixed conifer, and spruce-fir forests; piñon-juniper woodland; and Great Basin grassland potential natural vegetation types (PNVTs) are considered.

In the analysis for this resource, key assumptions and methodology include the following:

- Wood products volumes potentially available from the Apache-Sitgreaves NFs are byproducts of restoration treatments that will move vegetation toward desired conditions. Management of all PNVTs would be needed to meet desired conditions.
- The 1987 plan mapped forest and woodlands using an outdated cover type classification, based on the visibly dominant tree or plant species at the time of mapping. This updated analysis uses PNVTs, which may not be the currently dominant vegetation. For example, what appears to be wet mixed conifer forest (infrequent fire type) may actually be dry mixed conifer (frequent fire type) where shade-tolerant species have become established in the absence of frequent fires.
- Restoration volume estimates were derived from cutting green trees in the vegetation modeling (VDDT model). See the "Vegetation" section and appendix B for information about the VDDT model and PNVTs. Volume estimates for fire-killed trees are not provided by the model.
- Appropriate cutting methods and other treatment types will vary by site-specific objectives and existing condition. Decisions about treatment methods will be made at the project-level.
- Markets will exist for all cut materials. At least 5 percent of cut materials may remain on the ground as broken logs, limbs, and/or debris left for soil stability, productivity, and wildlife needs. About 95 percent of the cut materials would be offered for removal.
- Increasing public and small market demands for firewood and small salvage sales of sawlogs, posts, poles, novelty woods, and/or pulp volumes will be similar under all alternatives.

- Christmas trees, wildlings, seed cones, novelty woods, and other tree products will be available to meet public demand. Amounts will be the same under all alternatives.
- Prescribed fire (planned ignition) as a silvicultural tool will only be used in accordance with prescriptions from an approved burn plan designed to meet land management plan desired conditions.
- Low severity fire (both planned and unplanned ignitions) on suitable timberlands will be used to reduce ground fuels and remove slash and would be used to maintain or move toward desired conditions (i.e., the age class distributions desired for uneven-aged structure, regulated forest, and sustained volume yields).
- The use of wildland fire (e.g., moderate and high severity burns, planned and unplanned ignitions) as a thinning tool on suitable timberlands may occur when necessary to meet resource objectives. Moderate and/or high severity fire may not achieve the age class distributions desired for uneven-aged structure, regulated forest, and sustained volume yields.
- At this time, no suitable timberland acres burned in the 2011 Wallow Fire are expected to require reclassification as non-suitable due to permanently reduced soil site productivity.
- Currently deforested acres would not need thinning during this planning period.

Affected Environment

Past forest growth and mortality, previous management, and disturbance patterns have produced the current forest tree species composition, sizes, densities, and conditions, which affect the species and volumes of wood and other tree products available for cutting treatments now and in the future.

Across the Apache-Sitgreaves NFs, the annual gross forest growth and net forest growth (gross growth minus mortality) have far exceeded cutting levels. The annual gross growth in Apache-Sitgreaves NFs ponderosa pine forests has been as much as 12 times the annual mortality (excluding mortality from uncharacteristic wildfire); Douglas-fir stands growth has been at least 8 times mortality (Rogers, 2003). The total of mortality and cutting levels is far below gross growth rates for trees inventoried in Arizona national forests (O’Brien, 2002). In other words, cutting rates have been far less than net growth rates.

In the past 30 years, an average of 720 cubic feet (CF) of wood volume per acre has been added as surplus net growth, in addition to the desired sustainable volume. This surplus needs to be removed each entry to maintain desired conditions. Youtz and Vandendriesche (2012) suggest that a return cutting entry of 30 years is needed on average using the group selection system for uneven-aged management to maintain a regulated sustainable forest that meets desired conditions.

Every three decades without treatment adds to the backlog of overgrowth. On the Apache-Sitgreaves NFs, several acres of suitable forest land have not been thinned in over 40 years, resulting in surplus of over 1,000 CF on these lands. Unthinned lands suffer from conditions which contribute to the departure from desired conditions. These areas are at risk of stand mortality due to weakened tree vigor, disease intensification and spread, epidemic insect attacks, and/or uncharacteristic wildfire.

Normal disturbance regimes (primarily characteristic wildfire) which previously acted as natural thinning agents have been altered, giving rise to overgrown conditions. Abnormal disturbances (e.g., uncharacteristic wildfire, unprecedented insect/disease outbreaks) have produced undesirable stand-replacement conditions across large areas (Forest Service, 2008a; Lynch et al., 2010). Noticeable (non-fire) losses of large/old trees have been observed in all forested PNVTs, especially due to competition in overgrown stands. Overgrowth reduces individual tree growth, vigor, and the ability to endure bark beetle attacks and drought years (Covington et al. 1997; Friederici, 2003).

Two very different existing condition categories now occur across the forested PNVTs of the Apache-Sitgreaves NFs (see table 144 below):

- **Forested/Overgrown** – Approximately 71 percent of the current forested PNVTs have tree stocking and growth levels which require some degree of tree thinning to restore and/or maintain desired conditions. Without additional severe disturbances accelerating immediate and complete tree mortality, these areas can contribute industrial cutting volumes in the first decade and beyond.
- **Deforested/Early Development** – Conversely, an average of 29 percent of the current forested PNVT vegetation structural states are now temporarily in deforested states (22 percent) or early developmental states (7 percent) that require reforestation and growth for restoration to desired conditions. This condition is primarily attributed to the 2011 Wallow Fire, the 2002 Rodeo-Chediski Fire, and other fires that caused tree mortality exceeding or eliminating net growth. These areas cannot provide industrial cutting volumes in the next one to three decades.

Table 144. Acres and percent by forested PNVT in forested/overgrown or deforested/early development condition

Forest PNVT	Forested/ Overgrown Acres (Percent)	Deforested/ Early Development Acres (Percent)
Ponderosa Pine	475,743 (79%)	126,463 (21%)
Dry Mixed Conifer	100,562 (68%)	47,323 (32%)
Wet Mixed Conifer	89,005 (50%)	88,998 (50%)
Spruce-Fir	8,127 (46%)	9,540 (54%)
Total	**673,437 (71%)**	**272,316 (29%)**

On the forested/overgrown lands, net growth is expected to outpace natural (non-fire) mortality; regular thinning (prescribed cutting and/or wildland fire) would be necessary to reduce overgrowth, develop desired uneven-aged forest structure, and/or to prevent growth stagnation and movement away from desired conditions. Where moderate-severity fire has occurred on these lands, natural mortality levels are expected to remain high for approximately the next 6 years, due to fire-related tree stress, sudden exposure to weather extremes, weakened roots, greater exposure to lightning and/or prevailing winds, and greater susceptibility to insect/disease attack. Once surviving trees have stabilized, they are expected to need thinning for maintenance of desired forested conditions.

The deforested lands (approximately 203,378 acres) can be further divided into three categories:

- Lands which can be expected to successfully regenerate native tree species naturally (approximately 54 percent or 110,629 acres) at low management cost. This is about 12 percent of all forested PNVTs.
- Lands which would need tree planting to restore forest cover (approximately 19 percent or 37,695 acres) at high management cost. This is about 4 percent of all forested PNVTs.
- Lands likely to convert to long-term grass/forb/shrub/rock cover rather than return to tree cover (approximately 27 percent or 55,054 acres) at the expense of lost forest/timber production acres (Roccaforte et al., 2012; ERI, 2011; Savage and Mast, 2005; Alexander, 1974; Jones, 1974). This is approximately 6 percent of all forested PNVTs. Tree planting can help mitigate this condition by accelerating post-fire succession back to tree cover.

Lands Tentatively Suitable for Timber Production

Timber production is defined as the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees for cutting into logs, bolts, or other round sections for industrial or consumer use. Timber production does not include firewood or products harvested from unsuitable lands.

Lands are identified as suitable or not suitable for timber production (suitable and non-suitable timberlands) during the plan revision process. Appendix B details the steps used in the suitability determination. The first step of the suitability determination is to identify the lands that are tentatively suitable for timber production.

Table 145 displays the criteria used to identify lands as tentatively suitable timberlands. The Apache-Sitgreaves NFs have approximately 808,000 acres considered tentatively suitable. Suitable timberland does not dictate tree cutting. It means that all cutting treatments done on suitable lands would be limited by the ASQ volume (see the following section on “Allowable Sale Quantity”).

Table 145. Criteria used to determine tentatively suitable timberlands in all alternatives

Criteria	Acres	Total Acres
TOTAL Apache-Sitgreaves NFs		2,110,196
Non-NFS Land	94,844	
Total NFS Lands		2,015,352
Nonforest Lands		**1,039,258**
Areas not defined as forest land[a]	4,250	
Quarry, urban/agriculture, water		
Grasslands	344,033	
Great Basin, montane/subalpine, semi-desert		
Woodlands	617,094	
Madrean pine-oak, piñon-juniper		
Interior chaparral	55,981	
Wetland/cienega riparian areas	17,900	
Forested lands withdrawn from timber production[b]		**87,190**
Designated Wilderness	20,628	
Bear Wallow, Escudilla, Mount Baldy		
Blue Range Primitive Area	43,258	
Research Natural Area	219	
Eligible or suitable wild and scenic river corridors or areas classified as wild	23,085	
Irreversible resource damage likely		**23,952**
Unsuited/unstable soils (sensitive and unstable)	23,952	
Inadequate restocking		**56,584**
Low reforestation potential based on soil properties	56,584	
Lands Tentatively Suitable for Timber Production		808,368[c]

[a] Forest land is defined as having greater that 10 percent overstory canopy cover at stand maturity.

[b] Some categories overlap areas already withdrawn in nonforest lands.

[c] The tentatively suitable lands in alternative A equal 807,289 acres. There are more acres in research natural area (1,882 acres).

Allowable Sale Quantity (ASQ)

The allowable sale quantity volume control concept enacted by law (National Forest Management Act of 1976) was intended to prevent excessive tree losses due to overcutting beyond sustainable forest levels on suitable timberlands. The ASQ is the quantity of timber that may be sold from suitable timberland within the Apache-Sitgreaves NFs for a time period specified by the plan. ASQ volume is expressed as the average annual allowable sale quantity. For timber resource planning purposes, the allowable sale quantity applies to each decade during the planning horizon period and includes only chargeable volume[38]. ASQ volume does not include firewood or other nonindustrial wood.

ASQ volume estimates only include chargeable volumes of industrial wood[39]. The ASQ calculation includes estimated green tree cutting volumes from the VDDT model which vary by alternative; extra small sales and permits sold for live and/or dead poles; and miscellaneous salvage timber. Small sales, permits, and miscellaneous salvage are considered to be a constant addition across all alternatives.

ASQ volume and a timber base sale schedule were published with the 1987 plan. They were specific and prescriptive. The original ASQ volume of 119 million board feet (MMBF) was subsequently reduced to an interim ASQ of 99 MMBF (198,000 CCF[40]) of sawtimber per year through forest plan amendment one. The ASQ volume for **alternative A**, the no action alternative, has been recalculated in this analysis for consistency across **all alternatives** and is based on current vegetation conditions.

Ongoing monitoring would evaluate cutting levels compared to the ASQ. The suitable timberland classification would be updated as conditions change.

Long-Term Sustained-Yield Capacity

Long-term sustained yield (LTSY) is the calculated annual volume of wood per acre that can be harvested from suitable timberlands, which does not exceed annual net growth volume per acre after desired conditions have been met for multiple resource objectives. A weighted average LTSY has been calculated as 24 cubic feet (CF) per acre per year for all Apache-Sitgreaves NFs' forested PNVTs in suitable timberlands based on current and regional data (Youtz and Vandendriesche, 2012). This is slightly higher than the 20 CF per acre per year capacity identified in the 1987 plan.

LTSY multiplied by the total suitable timberland acreage determines the long-term sustained-yield capacity (LTSYC). This concept is one means of measuring forest sustainability, consistent with ecological desired conditions (see "Appendix B Timber Calculations"). Ideally, ASQ volume should equal or fall just short of the LTSYC once desired conditions are met. After desired conditions are achieved, management on suitable timberlands should be consistent with the LTSYC level (no cutting departure above the LTSYC); annual cutting levels would not exceed annual net growth rates. On suitable timberland acres, the LTSYC is a way to further incorporate the social and economic desired condition of providing a long-term, dependable source of wood products, while maintaining desired multiple-use objectives.

To comply with the National Forest Management Act (NFMA) and Multiple Use-Sustained Yield Act (MUSYA), long-term sustained yield also means that ASQ volumes harvested from suitable

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[38] Chargeable volume of industrial wood is from tree species that are saleable as sawtimber logs, pulpwood bolts, poles, or other roundwood sections (excluding firewood) based on regional utilization standards and cut from suitable timberlands.

[39] Industrial timber species (5 inches diameter and greater) include ponderosa pine, Douglas-fir, white fir, southwestern white pine, blue spruce, Engelmann spruce, and corkbark fir.

[40] CCF = 100 cubic feet.

timberlands cannot decline from one decade to the next. More explanation of non-declining ASQ can be found in Appendix B.

Wood and Tree Products Availability

Wood products can be provided from both suitable and non-suitable timberlands. The most common wood products (e.g., industrial[41] and nonindustrial[42], live and dead wood) on the Apache-Sitgreaves NFs include sales and permits for the following:

- Ponderosa pine, Douglas-fir, southwestern white pine, white fir, blue spruce, Engelmann spruce, and corkbark fir
  - Sawtimber and house logs (9 inches or greater in diameter)
  - Pulpwood or roundwood (5 to 8.9 inches in diameter)
  - Poles, posts, vigas, latillas, rails
  - Laminated beams
  - Paneling and trim molding
  - Firewood
  - Biomass (chips)
  - Furniture
- Piñon and all juniper species
  - Poles, posts, vigas, latillas, rails
  - Firewood
  - Biomass
  - Furniture and novelty wood
- Aspen, Gambel-oak, and other oak species
  - Firewood
  - Furniture and novelty wood
  - Poles, posts, rails
  - Interior paneling
  - Evaporative cooler pad excelsior
  - Livestock bedding

[41] The less than 5-inch diameter size materials, including tops and limbs from timber species may be utilized as non-ASQ biomass.

[42] Nonindustrial (non-ASQ) species include aspen, junipers, piñon, Chihuahuan pine, oaks, and any industrial species cut from nonsuitable timberlands. Wood cut as nonindustrial may be used as firewood and/or biomass.

Christmas trees, live seedling/wildling transplants, green seed cones for nurseries, green boughs for holiday decorations and wreaths, and piñon nuts are also available.

Within the life of the 1987 plan, annual harvest volumes have varied from 5,000 to 100,000 board feet (MBF) with annual treatment acreages ranging from 2,500 to 30,000 averaging 9,400 acres (Forest Service, 2008a). Acreages treated under the White Mountain Stewardship project (2004 to 2014) are slightly higher at approximately 12,000 acres per year.

With implementation of the 1987 plan, vegetation management on forested lands emphasized even-aged cutting methods: seed cuts, final overstory removals, intermediate thinnings, and a few clearcuts/seedling plantations. Sanitation/salvage cuts have also been used. Most vegetation management was accomplished through timber sales that focused on cutting trees over 9 inches in diameter (or over 12 inch diameter in some cases). Multiproduct sales (sales which offer both sawtimber and pulp sizes) targeted trees in the 5- to 9-inch class as well as larger trees, but the lack of markets for the smaller sizes resulted in many projects not being completed.

When the 1987 plan was amended in 1996 to address Mexican spotted owl, northern goshawk, and old growth, it initiated direction to emphasize uneven-aged cutting methods (e.g., group selection, individual tree selection). Implementation was met with varying degrees of success, due to various factors. Only thinning of marketable size trees (usually 9-inch diameter and larger) was successfully implemented. Thus many acres became further overgrown with trees under 9 inches in diameter, which can act as understory ladder fuels.

Uncharacteristic wildfires in the early 2000s highlighted the need for fuels reduction projects. Treatment of all vegetation types, regardless of timberland suitability, became a priority near communities, private lands, and developed recreation areas. The treatment emphasis on removing understory ladder fuels led a diameter cap (an upper cutting size limit) as the way to focus on removing the overabundant, small diameter trees.

The Healthy Forests Restoration Act of 2003 fostered the development of community wildfire protection plans that incorporated programmatic and widespread use of diameter caps (limiting cuts to smaller diameter trees) (Logan Simpson Design, 2004, 2004a, and 2005) across the forests. Meanwhile, the Stewardship End Result Contracting Projects statute (16 U.S.C. 2104) opened a new era of cutting small trees to reduce wildfire hazards under 10-year long stewardship service contracts. On the Apache-Sitgreaves NFs, this meant that most wood volume was no longer removed through timber sales. Service contractors were paid under the White Mountain Stewardship Project to remove wood volume; a strategy used to reduce fuels near communities until local small tree markets are established and small tree wood values offset treatment costs.

Even-aged cutting methods and diameter caps have resulted in a longer timeframe to produce uneven-aged forests and woodlands. In areas where even-aged management or removal of small diameter trees has occurred, the next treatment (cutting entry) may be limited to large trees (16 inch and greater diameter) (Triepke et al., 2011). Stand-replacement fire results in essentially even-aged regeneration areas for at least 60 years after new tree establishment. In all cases, subsequent entries could provide variable harvest volumes and product types, while conversion from even-aged to uneven-aged structure proceeds over time.

Environmental Consequences of Alternatives

All alternatives would propose various mixtures of three basic vegetation treatments during the planning period to move toward desired conditions. These include the following:

- Tree cutting on some forested/overgrown areas, followed by low severity fire to reduce ground fuels;
- Moderate and/or high severity fire to thin other forested/overgrown areas and reduce ground fuels;
- Tree planting on some deforested areas.

All three treatment types indirectly impact the amount and availability of sustainable wood products. The number of total annual cutting and wildland fire treatment acreages by alternative in table 146 below (regardless of timber suitability classification) was analyzed.

Table 146. Annual cutting and wildland fire treatment acres for all PNVTs, suitable and non-suitable timberlands, by alternative

Alt.	High		Low		Average		
	Cutting Treatment	Wildland Fire Treatment	Cutting Treatment	Wildland Fire Treatment	Cutting Treatment	Wildland Fire Treatment	Total Cutting and Fire
A	—	—	—	—	12,182	6,844	19,026
B	30,327	43,771	8,852	14,087	19,591	28,930	48,521
C	42,651	22,586	5,342	3,124	23,997	12,857	36,854
D	25,440	78,772	6,465	19,079	15,954	48,927	64,881

Suitable Timberlands

Timberland suitability was determined for each alternative. The original 1987 plan suitability classification did not follow the criteria and classification outlined below. In order to compare the alternatives, **alternative A** was recalculated using the same process as the **action alternatives**. The suitability criteria can be found in chapter 4 of the proposed plan. In addition to these criteria, other considerations (e.g., timber production cost efficiency) were used to further eliminate acres from suitability classification. See appendix B for a more detailed description of the suitability determination.

Results of the suitability determinations are provided in the following table. **Alternative A** would have the most acres suitable for timber production, followed by **alternatives C and B**. **Alternative D** would have no suitable acres due to the design and objectives of this alternative (e.g., primarily wildland fire treatments, high acreage recommended for wilderness).

Suitable timberland maps for **alternatives A, B, and C** are shown below. **Alternative D** would have no suitable timberlands (see figure 69 through figure 74).

Table 147. Lands suitable and not suitable for timber production by alternative

Classification	Alt. A Acres	Alt. B Acres	Alt. C Acres	Alt. D Acres
Lands Tentatively Suitable for Timber Production	**807,289**	**808,368**	**808,368**	**808,368**
Lands where Management Area Direction Precludes Timber Production	12,258	65,497	27,321	145,118
Lands where Management Objectives Limit Timber Harvest	30,159	76,537	91,067	663,250
Lands that are Not Economically Cost Efficient	0	69,590	85,234	NA
Lands Not Appropriate for Timber Production	**42,417**	**211,624**	**203,622**	**808,368**
Lands Suitable for Timber Production	**764,872**	**596,744**	**604,746**	**0**
Lands Not Suitable for Timber Production	**1,250,480**	**1,418,608**	**1,410,606**	**2,015,352**

Alternative A would provide the most suitable timberland acres; while **alternative C** would provide slightly more suitable timberland acres than **alternative B**. Steep slopes (over 40 percent) were included in the 1987 plan (**alternative A**) as suitable timberlands for cable harvest. **Alternatives B and C** would not include any steep slopes because these areas are not economically feasible to harvest. Spruce-fir forest was classified as non-suitable because the majority of it is located in withdrawn lands, is not cost efficient, and/or is located in MSO protected habitat as defined in the MSO recovery plan (USFWS, 2012b).

Alternative A would have the most acres managed for long-term sustained yield of wood products. **Alternatives C and B** would have fewer acres managed for long-term sustained yield of wood products.

In **alternatives A, B, and C**, use of moderate and/or high severity fire for tree thinning and density reduction, especially across large areas of suitable timberland, would increase the risk that those acres could not become regulated with the balanced and sustainable progression of age classes needed to ensure non-declining even-flow[43] of future harvest volumes.

Alternative D would have no suitable timber acres because wildland fire would be the primary tool to thin the majority of acres. After the few mechanical acres are cut, they would be maintained primarily using prescribed fire. This alternative would not provide a sustained yield of harvest volumes on a regulated, non-declining even-flow basis for the long term. This does not mean that no volume would be available to supply markets. It only means that industrial volumes of traditional sawtimber and pulpwood would not be ensured for long-term sustained yield. See the “Total Wood Products” section below. In addition, **alternative D** allocates the most land to the Recommended Wilderness Management Area which would preclude timber harvest.

[43] Nondeclining even flow is a policy governing the volume of timber removed from a national forest, which states that the volume planned for removal in each succeeding decade equals or exceeds that volume planned for removal in the previous decade.

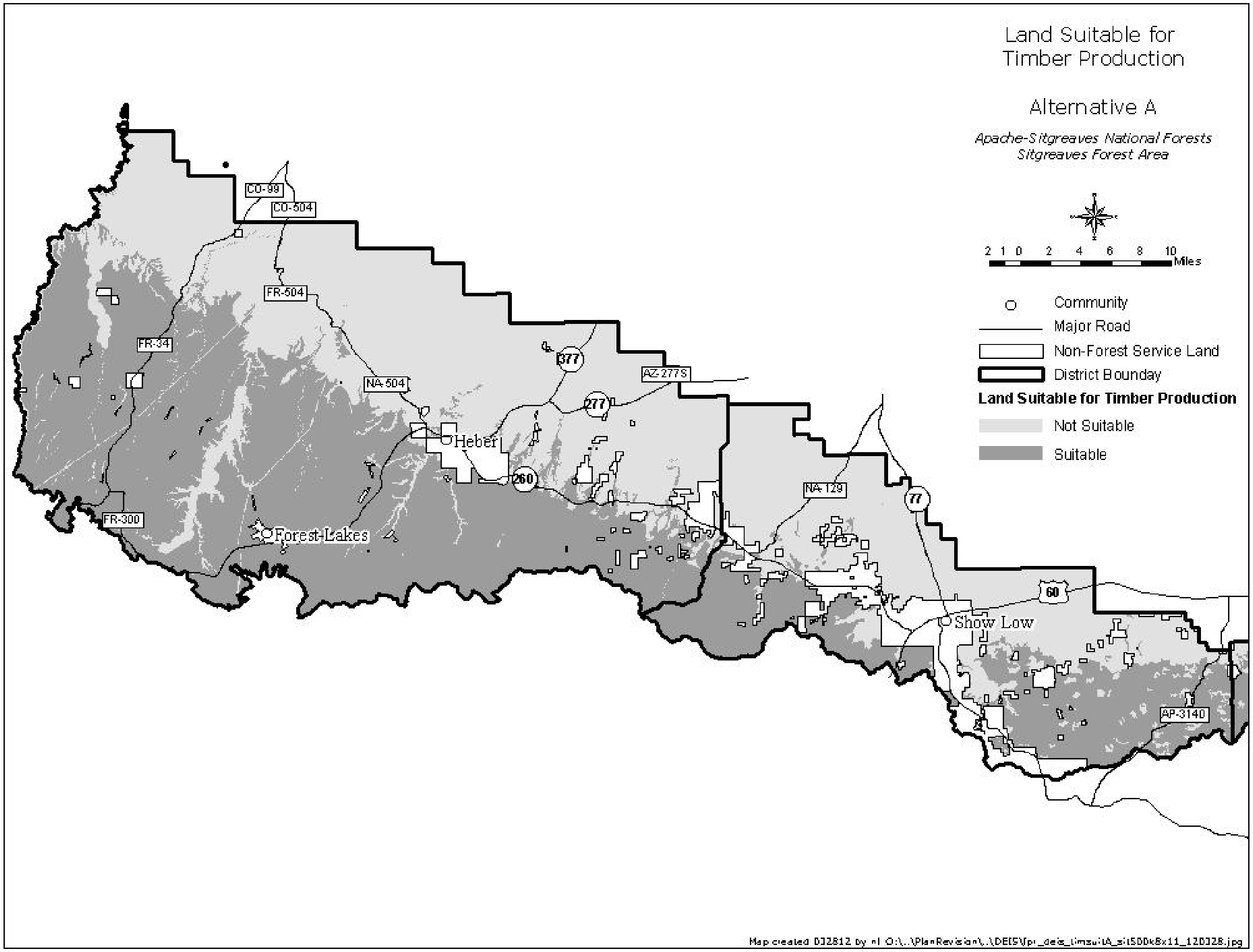

Figure 69. Map of land suitable for timber production, alternative A – Sitgreaves NF

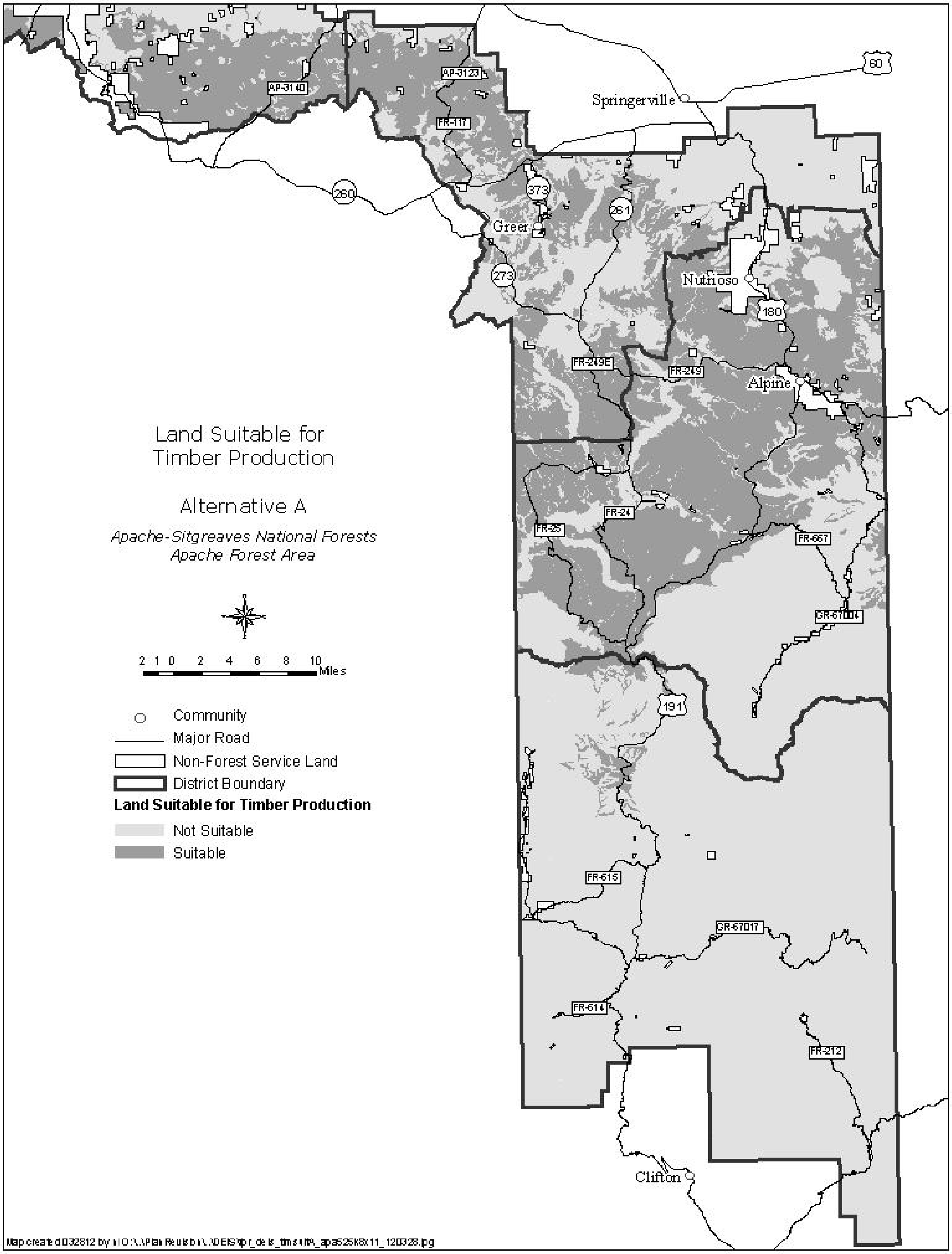

Figure 70. Map of land suitable for timber production, alternative A – Apache NF

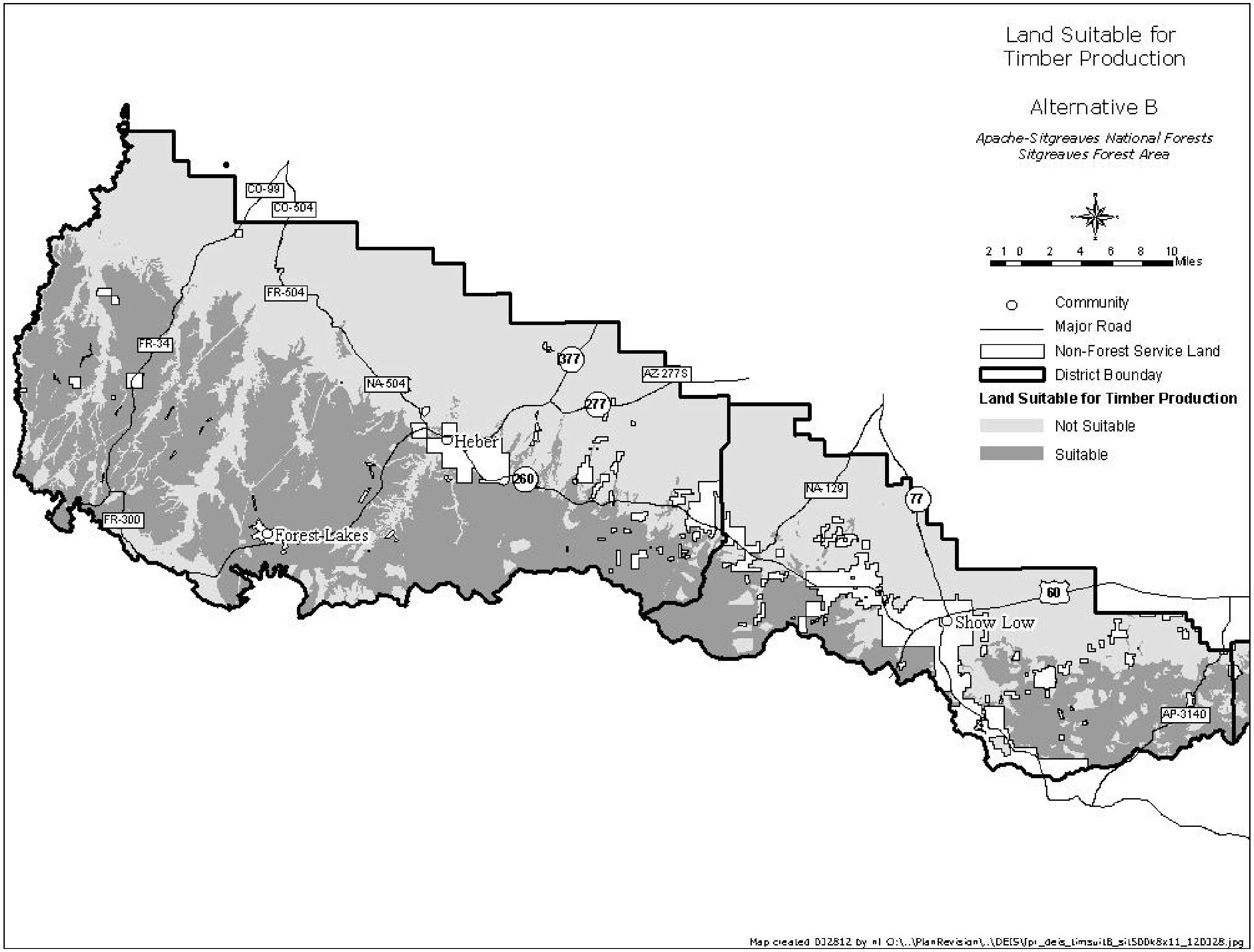

Figure 71. Map of land suitable for timber production, alternative B – Sitgreaves NF

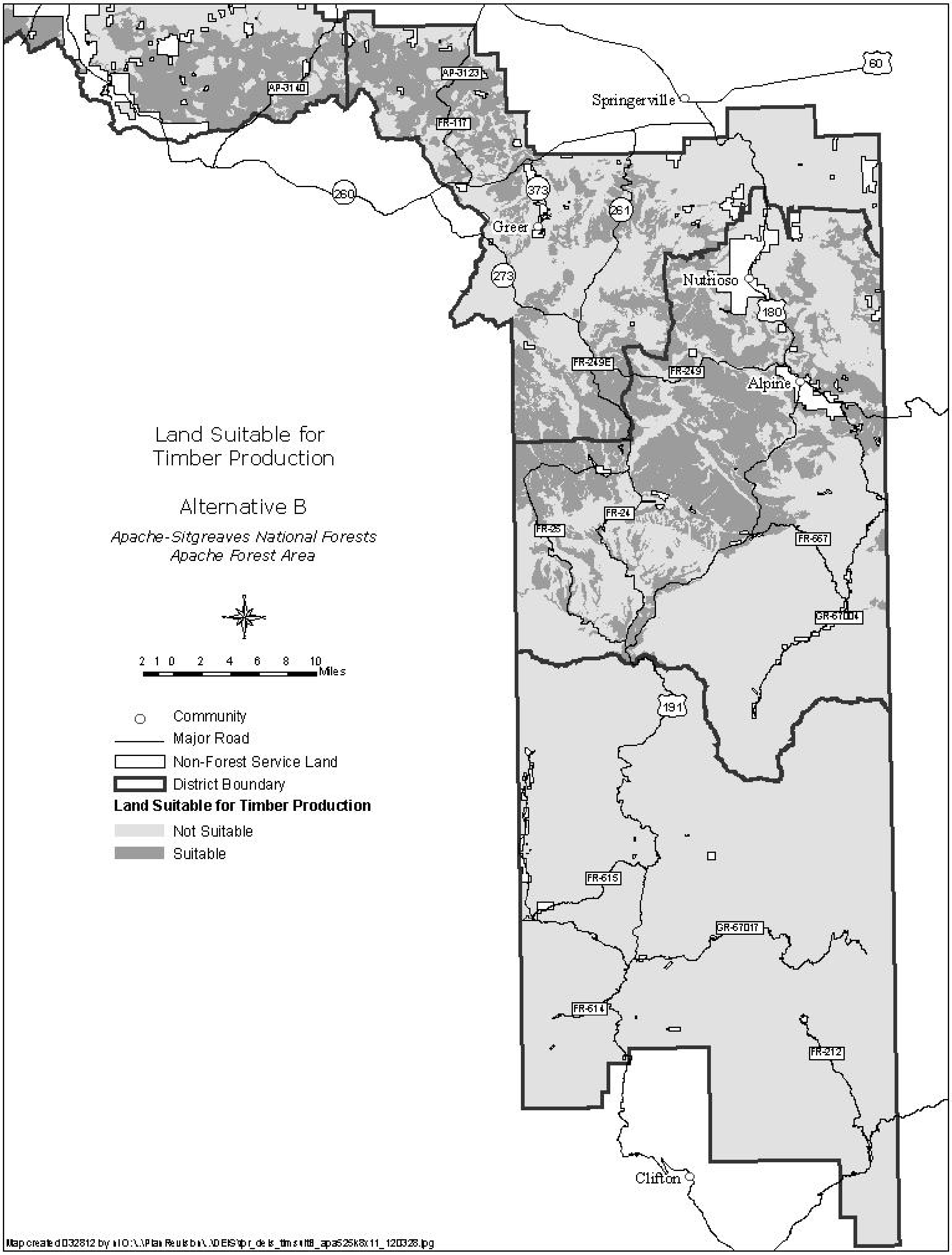

Figure 72. Map of land suitable for timber production, alternative B – Apache NF

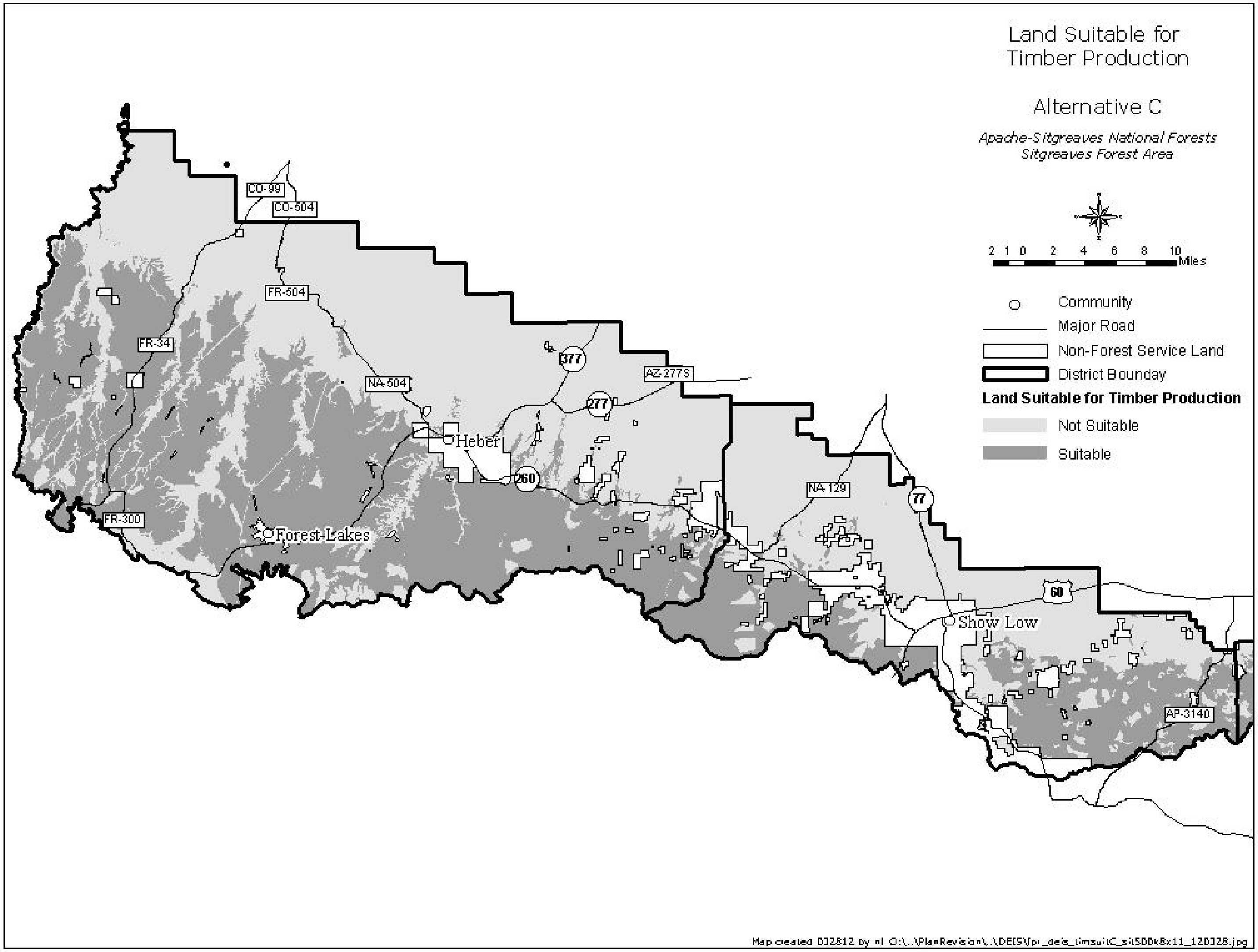

Figure 73. Map of land suitable for timber production, alternative C – Sitgreaves NF

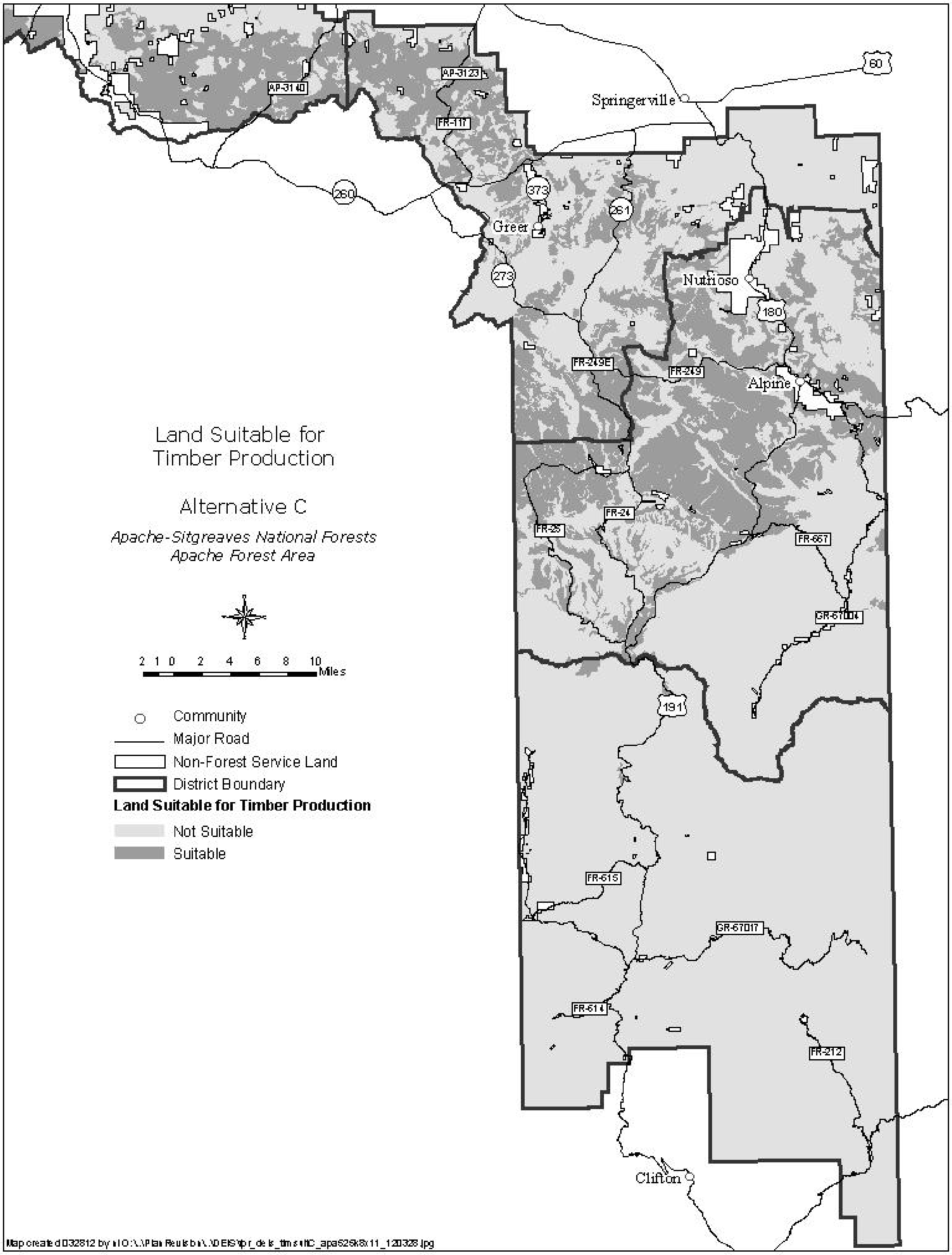

Figure 74. Map of land suitable for timber production, alternative C – Apache NF

Allowable Sale Quantity (ASQ)

ASQ is expressed as an annual average of industrial wood cutting volumes from suitable timberlands to meet multiple-resource objectives. Table 148 displays the ASQ volume estimates for the first decade needed to implement restoration treatments and to meet public demand for sawtimber, pulp, and pole sales.

Table 148. ASQ volume from suitable timberlands for the first decade (rounded to nearest thousand)

Cutting Treatment	Alt. A	Alt. B		Alt. C		Alt. D	
Objective Level	Average	High	Low	High	Low	High	Low
Annual Range of ASQ, in CCF	NA	122,000	26,000	268,000	39,000	0	0
Annual Average ASQ, in CCF	73,000	74,000	74,000	153,000	153,000	0	0

Alternatives A, B, and C would have different ASQs because they were based on the expected level of cutting treatments on suitable timberlands (table 149). In some years acres cut would not reach the high treatment objective level, but could fluctuate between the low and high levels. **Alternative D** would have no ASQ volume because there are no suitable timberlands.

ASQ volume for **alternative B** would be 122,000 CCF per year as the maximum allowable sale quantity from suitable timberlands. Under **alternative C,** it would be 268,000 CCF maximum for any given year. For comparison, the highest total harvest in recent years occurred in 2011 and was approximately 103,000 CCF.

Consequences of implementing the alternatives are that **alternative C** would offer the most ASQ volume of traditional sawtimber and pulpwood offerings for sale to the markets that may desire these products.

Alternative A would offer less ASQ volume than **alternatives B and C** because it does not have a high treatment objective. This amount or some higher amount could become the replacement ASQ for the 1987 plan if there had been no other need for change to revise the plan (see chapter 1).

Suitable timberland acres are capable of producing greater annual harvest volumes than those shown in the above table. However, use of wildland fire under **alternatives A, B, and C** would reduce available green harvest volumes because varied amounts of moderate and/or high severity fire would be used to intentionally thin the forests.

Alternative B would reduce the most green volume because it proposes to use more moderate and/or high severity fire to thin trees on forested lands, including some suitable timberlands, during the planning period. **Alternative C** would use less moderate and/or high severity fire on suitable lands to thin trees, resulting in more green volume available for cutting and industrial wood. **Alternative A** would reduce the least green volume, because it uses the least moderate and/or high severity fire.

Trees intentionally killed by wildland fire treatments may or may not be salvaged. Salvage of such trees would require removal within approximately 3 to 4 years post-burn, before wood borers and other decay agents reduce the amount of solid wood fiber and market utility. Under **all alternatives**, unanticipated large-scale salvage volume (e.g., wildfire kill, blow down, insect/disease mortality) does not count toward the ASQ per the National Forest Management Act.

Long-Term Sustained-Yield Capacity

The LTSY level of 24 CF per acre per year becomes a baseline for comparison of estimated wood product outputs (volumes) by alternative. The LTSYC for **alternative A** is approximately 184,000 CCF, **alternative B** is 143,000 CCF, and **alternative C** is 145,000 CCF. See table 149.

Under **all alternatives**, except **alternative D**, planned, scheduled entries of tree cutting on suitable timberlands would be necessary to move the forests toward an uneven-aged (regulated) balance of age classes and then to maintain the desired condition.

Long-term Sustained Yield Capacity in Relation to Estimated Industrial Harvest Volumes

As each alternative has different amounts of suitable timberlands, the LTSYC varies accordingly. Table 149 displays the annual ASQ volumes based on the high cutting treatment level for decades 1 to 5, compared to the LTSYC for each alternative.

Table 149. Estimated annual ASQ volume by decade by alternative (volumes rounded to the nearest thousand)

Annual High[a] Cutting Treatment Volumes in CCF	Alternative A Annually Cuts 10,041 acres[b] of 764,872 acres of Suitable Timberland LTSYC = 184,000	Alternative B Annually Cuts 14,037 acres of 596,743 acres of Suitable Timberland LTSYC = 143,000	Alternative C Annually Cuts 31,893 acres of 604,746 acres of Suitable Timberland LTSYC = 145,000	Alternative D Annually Cuts only on Nonsuitable Timberland LTSYC = 0
ASQ Decade 1	73,000	122,000	268,000	0
ASQ Decade 2	73,000	122,000	202,000	0
ASQ Decade 3	73,000	123,000	183,000	0
ASQ Decade 4	73,000	125,000	178,000	0
ASQ Decade 5	73,000	126,000	178,000	0

[a] Alternative A only has an average.

[b] Acres are based on the estimated cutting treatments modeled for ponderosa pine, dry mixed conifer, and wet mixed conifer forests on suitable lands only.

As shown above, when cut at the highest treatment objective levels modeled, **alternatives A and B** volumes would not decline and would remain below the LTSYC. By cutting at a relatively level trend across all five decades, **alternative A** would fail to reduce any backlog of overgrowth by barely keeping up with new growth each decade. **Alternative B** would make more progress than **alternative A**, but would not reach the LTSYC by decade 5.

In contrast, the high objective ASQ volumes for **alternative C** would decline while exceeding the LTSYC in a departure situation. **Alternative C** would reduce the most overgrowth backlog in the first three decades and would continue to remove more backlog in decade 4 until leveling off in decade 5.

Any departure (exceedance) level of cutting above the LTSYC, such as seen in **alternative C**, especially in the early planning decades, is justifiable because of the following:

- Current age class distributions are skewed and do not represent desired conditions. Many acres are even-aged. Some age classes are missing. Much of the forests have too many small to medium diameter trees that act as ladder fuels and compete with larger trees.
- High tree mortality could continue because of uncharacteristic wildfires, abnormal insect outbreaks, elevated disease levels, new disease arrivals, and accelerated tree stress and deaths from competition.
- Several small tree-based industries have developed to utilize saplings and smaller diameter trees. New jobs have been created or have returned to Apache and Navajo Counties. Since 2009, rising market demands have allowed local operators to treat all acres offered, almost as fast as the forests can make them available. Limiting the ability to cut surplus tree volume growth above the LTSYC level could have some degree of adversely impact local communities.
- Multiple resource objectives would be best met by balancing forest wood volume growth rates with removal of forest wood volumes. This would reduce the risk of uncharacteristic wildfires and other extreme or long-lasting disturbances. Those uncharacteristic events do not contribute to the desired condition of restoring ecosystems to benefit watershed/soils stability, riparian habitats and aquatic organisms, wildlife and fish habitats, ground vegetation and herbaceous cover, range production, water and oxygen cycles, and recreation opportunities, as well as economics and the human environment.

In a regulated (sustainable) forest, annual cut equals annual net growth, so that the forest never becomes overgrown or stagnant. **Alternatives A and B**, because they produce harvest volumes below the LTSYC, would result in overgrown forests more susceptible to uncharacteristic disturbances (e.g., high severity wildfire, insect/disease outbreaks). These undesired events could deforest additional acreages. **Alternative C**, because it produces volumes above the LTSYC, would contribute to reducing overgrowth and offering better opportunities to maintain forest lands at a sustainable level for at least the first four decades.

Non-declining even flow of harvest volume from one decade to the next is not expected under **alternative C** until desired conditions are met. By the 5th decade, **none of the alternatives** would treat enough acres fast enough to reach desired conditions because the alternatives were realistically designed to reflect anticipated budgets and workforce capabilities. Because volumes were not modeled beyond the 5th decade, it is not possible to predict when the ASQ volumes might meet the LTSYC.

Because **alternatives A and B** cut below the LTSYC, the forest would remain threatened by high mortality losses to uncharacteristic disturbance events. At some point **alternative C** would need to align with the LTSYC (i.e., regulated forest) to prevent overcutting. VDDT modeling indicates that after 50 years of treatments the forested PNVTs would not fully reach desired vegetation conditions. Review of all VDDT model run vegetation outcomes and trends for **all alternatives** indicate that changes in management strategy would likely be needed following the planning period (see the “Vegetation” section and “Vegetation Specialist Report” (Forest Service, 2014t)).

For example, unlike **alternatives A and C**, modeling indicates that **alternative B’s** restoration strategy would need to change after this planning period to steadily increase cutting treatments in decades 2 through 5 on closed canopy acres and shift to emphasizing low severity prescribed fire, in order to sustain a non-declining even flow of ASQ volumes. It is assumed that continued restoration treatments toward desired conditions on suitable timberlands beyond decade 5 would eventually increase ASQ levels closer to the LTSYC.

Cuts under **alternative D** are not comparable because no suitable timberlands are present.

Total Wood Products

Trees cut from non-suitable lands can also provide wood and tree products for local markets. The proposed plan (chapter 4) displays the criteria where tree cutting is an appropriate activity for meeting desired conditions, including lands not designated as suitable timberlands.

Cuts from non-suitable lands may be a one-time entry, such as removing encroaching trees from grassland. Subsequent cuts may not be needed if desired conditions can be maintained with wildland fire. PNVTs with stump resprouting species (e.g., alligator juniper, oak species) may need additional cuts (or other tree control methods) that would produce less wood volume than the first entry.

The total annual mechanical treatment (cutting) acres by alternative for all PNVTs (regardless of timber suitability classification) are displayed in table 146. Table 150 below compares estimated wood product volumes for the 1st decade of plan implementation by alternative.

Table 150. Estimated ranges of annual wood product volumes potentially available to offer in decade 1, by alternative from all NFS lands (suitable timberlands and non-suitable)

Product Class	Alt. A	Alt. B		Alt. C		Alt. D	
Treatment Acres	Average	High	Low	High	Low	High	Low
Industrial Species[a] (5 inch DBH and greater) in CCF	80,172	139,395	28,544	299,545	41,924	48,403	6,065
Firewood[b] (nontimber conifer and hardwood species) in CCF	25,582	94,058	55,166	52,028	18,718	59,438	32,203
Biomass (non-industrial sizes and species) in tons or converted TO CCF[c]	348,124 or 99,464	585,799 or 167,371	142,184 or 40,624	1,324,767 or 378,505	141,881 or 40,537	246,798 or 70,514	66,026 or 18,865
Total of all wood products, all (CCF)	**205,218**	**400,824**	**124,334**	**730,078**	**101,179**	**178,355**	**57,133**
Total of all wood products (CCF) based on average treatment acres	**205,218**	**262,579**	**262,579**	**415,629**	**415,629**	**117,744**	**117,744**

[a] Industrial species for all alternatives include different live trees modeled for restoration cutting, plus volume sold in small sales and permits (miscellaneous live and dead wildfire salvage, road and recreation site hazard trees, pulp, and poles).
[b] Firewood for all alternatives is different live trees modeled for restoration cutting plus permit sales for dead/down firewood and posts.
[c] 1 CCF = 3.5 tons. Source: R3 Measurements Specialist, based on R3 weight scale study conducted locally.

Alternative C would provide the highest average wood products volume for the 1st decade, followed by **alternatives B, A, and D**. However, the **action alternatives** would provide more average volume from non-suitable timberlands in the 1st decade than **alternative A**.

Under **all alternatives**, if plan desired conditions are met and maintained by the cutting practices used, the non-suitable timberland acres should provide long-term sustainable tree cover. However, these lands would not be subject to the ASQ volume or LTSYC controls.

Not included in the volume estimates are the dead tree volumes from moderate and/or high severity wildland fire (both planned and unplanned ignitions). If salvage volumes of fire-killed trees were included, **alternatives A, B, and D** could approach **alternative C** for total wood products available for at least the first few decades. However, this fire salvage would have to be harvested within approximately 3 to 4 years post-burn before decay agents destroy its wood fiber integrity.

Alternative A relies on tree cutting as the primary tool to thin the forest, with prescribed fire used as a secondary, slash cleanup tool. This approach is slow and costly. Currently, it is uneconomical to move raw cut materials more than 70 miles. Raw wood values are so low that little cut volume is sold. Currently, the Forest Service pays local operators to cut and remove the volumes from the White Mountain Stewardship projects. Where it is uneconomical to move raw wood, a portion of the cut volume may be left and would be disposed of at additional cost to the government. As displayed in the previous table, **alternative A** would provide far less volume to support large, landscape-scale restoration efforts like the Four Forest Restoration Initiative (4FRI, see the cumulative effects section), than would the high and average treatment objective levels of **alternatives C or B**. Yet, **alternative A** would provide more volume if these two alternatives were to consistently be implemented at their low objective levels.

The **action alternatives** would rely on wildland fire as a primary tool to thin more of the forest (kill trees) than **alternative A**. Thus, in some burned areas, there may be less green wood and more dead and fire-charred wood available as a harvestable byproduct, provided enough woody material is left onsite for ecological needs such as soils stability, site productivity, and wildlife habitat.

Alternative B would fall in between the cutting levels of **alternatives C and D**, due to the blend of treatment methods (see table 180 in appendix B) and acreages proposed. It employs a tree cutting and wildland fire strategy that restores more acres faster toward desired conditions than **alternative A**. It would not reach a regulated supply of sustainable timber as fast as **alternative C**, but would do so faster than **alternative A** and would be more sustainable than **alternative D**. Decreased suitable timberland acreage enables increased non-suitable lands to be treated with wildland fire-only, reducing the high costs associated with mechanized thinning, so more acres can be treated annually under **alternative D**.

Alternative C emphasizes a mix of more cutting treatments designed for optimum commercial timber species volume production (maximized growth and harvest) on suitable timber acres. It should produce more total wood volumes than would be harvested in the **other alternatives**. **Alternative C's** high objective cutting level would produce the most total wood volume to support large, landscape-scale restoration efforts like 4FRI. However, in the 1st decade this alternative's low objective cutting level would produce less total volume than either the high or low objective level of **alternative B**. This is because **alternative C** is focused on treating mostly suitable timberlands, while **alternative B** spends the 1st decade focusing on restoring grasslands and other non-suitable lands that can provide high volumes of non-ASQ wood products in addition to the ASQ volume.

Alternative D would provide the least wood volume for meeting social and economic desired conditions for local and regional markets and related jobs. It would produce the least wood product volumes, due to its emphasis on wildland fire as the primary treatment method, as well as a 16-inch diameter cap imposed on those acres that are mechanically thinned or cut. After one cutting entry, those mechanical acres would be maintained by regular intervals of planned and unplanned ignitions. Long-term consequences of continuing understory burning beneath an unthinned overstory may not meet desired conditions. An overabundance of large trees could eventually result in a generational gap that lacks younger trees to replace older trees over time (Triepke et al., 2011; Abella et al., 2006).

No long-term supply of wood volume could come from grassland acres once they are restored by cutting and maintained by wildland fire (a one-time harvest entry). **Alternatives B and D** would rely more heavily on firewood and biomass cut from grasslands than **alternative A**. **Alternative C** would rely the least on firewood and biomass cut from grasslands and other non-suitable timberlands.

Use of moderate and/or high severity fire combined with diameter caps as thinning tools used most heavily in **alternatives D and A**[44] would not ensure removal of undesired cone-producing species over 16 inches in diameter, thus perpetuating a species mix that is not well adapted to the site (Triepke et al., 2011). These two management methods are less certain to selectively leave the tree sizes, species, and arrangements desired for a truly sustainable uneven-aged structure and predictable wood volume production in more challenging climate conditions. Failure to restore all forests and woodlands to their desired species composition, size distribution, and spatial arrangement makes them more vulnerable to climate shifts or other uncharacteristic disturbances. **Alternatives C and B** would not use 16-inch diameter caps. **Alternative A** would use fewer diameter caps than **alternative D**. Therefore, **alternatives C and B** would provide more control over tree species composition on mechanically treated acres.

Under **all alternatives**, restoration and maintenance of green tree thinning could be reduced if large salvage sales of fire-killed trees dominate the forests' workload for the next 10 years. This could elevate the risk of losing more acres to uncharacteristic disturbances. Under **all alternatives**, too much emphasis to salvage dead trees would detract from treating the overgrowth backlog that threatens remaining green forest acres.

Forested/Overgrown Lands

Under **all alternatives**, 71 percent of the Apache-Sitgreaves NFs' forested PNVTs in the forested/overgrown category, regardless of suitability classification, would still have an imbalance of annual net growth far outpacing cutting levels (Rogers, 2003). Table 151 displays the minimum number of years needed to treat all the forested/overgrown lands (approximately 673,000 acres) once. Cutting and wildland fire treatments on suitable and non-suitable timberland acres are included.

Table 151. Average years required to treat all forested/overgrown acres with one entry by alternative

Alternative	Total Annual Thinning[a] Treatments (acres)	Percent of Forested/Overgrown Lands Thinned Annually	Years Required to Thin All Forested/Overgrown Lands
A	16,182	2.4	42
B	20,037	3.0	34
C	30,220	4.5	23
D	28,914	4.3	24

[a]Treatments include cutting andwildland fire, but not planting.

Annual thinning treatment percentages in **all alternatives** would affect a minor amount (less than 5 percent) of the forested PNVTs each year, with nature managing the rest. Without wildland fire as a thinning tool, treatment rates for **all alternatives** would be slower. Restoration rates could be too slow and costly without the use of wildland fire treatments, in addition to cutting, as a thinning tool to increase treated acres. Those untreated areas would still have trees that continue

[44] Alternative A (1987 plan) does not specify a 16-inch diameter cap. However, this diameter cap has been used as a treatment in recent and current vegetation management.

to grow and die, are affected by insects and diseases, and possibly burned or affected by other disturbance processes.

With less than 5 percent of lands treated annually, strategic placement on the landscape of those few treatments becomes far more important. In **alternative B** cutting would be prioritized in areas identified in community wildfire protection plans (CWPPs) and priority watersheds with large acreages of untreated ponderosa pine and dry mixed conifer forests. The areas in Navajo and western Apache Counties are nearer to rail lines and centralized markets, with the potential for greater success of being implemented as wood product transportation costs increase. **Alternative C** would emphasize treatments on suitable timberlands, the Community-Forest Intermix Management Area, and other lands that can contribute wood products. The suitable timberlands may or may not be near rail lines or centralized markets. **Alternatives A and D** would emphasize mechanized treatments around communities and in the Community-Forest Intermix Management Area (a subset of CWPPs), many of which have already been treated and now only require follow-up maintenance thinning that may produce less total wood volume in subsequent entries.

Alternative C would accomplish treatments the fastest, requiring 23 years to complete the needed thinning, followed by **alternatives D, B, and A**, respectively**. Alternatives A, B, and C** use a mix of cutting on some acres with wildland fire on other acres. **Alternatives C and D** treatment rates would permit more timely return entry intervals for maintenance of restored desired conditions on the most acres.

In contrast, **alternative D** would accomplish treatments in 24 years by using wildland fire as the primary tree thinning tool. All cuts done under **alternative D** would use diameter caps for large tree retention emphasis, which would slow progress toward or move those acres away from many desired conditions (Triepke, 2011; Abella et al., 2006). This is not evident in the VDDT model results for **alternative D** because the benefits of wildland fire on so many acres overshadow the negative cutting results.

For timeframes of thinning and wildland fire return treatment cycles analyzed for suitable and non-suitable timberlands, see the "Forest Products Specialist Report" (Forest Service, 2014i).

Deforested/Early Development Lands

Once adequate quantities of green seed have been collected for each native tree species, planting activities could begin on deforested lands. Cone collection may take about 3 to 10 years, depending on each species, but would be the same for **all alternatives**.

Alternative C would plant the most acres, especially on suitable timberlands in order to return them into timber production as soon as possible. This rate is at the extreme high end of current workforce capabilities. **Alternative B** would plant at a rate consistent with current workforce capability and would focus on reforesting a mix of both suitable and unsuitable lands for ecological recovery emphasis, including some Mexican spotted owl habitat.

Alternative A would plant at the lower end of current workforce capacity, focusing primarily on sites near private lands and along highly visible roadways. **Alternative D** would emphasize letting natural processes dominate so the vast majority of acres needing reforestation would regenerate naturally. The few acres planted would be near private lands and in some Mexican spotted owl habitat identified for accelerated recovery.

At the planting rates modeled (see the "Forest Products Specialist Report," Forest Service, 2014i), **alternative A** would plant an average of 880 acres a year, treating all deforested acres proposed for artificial reforestation within 43 years. **Alternative B** would plant an average of 1,623 acres a year, treating all deforested acres proposed for artificial reforestation within 23 years. **Alternative C** would plant an average of 2,066 acres a year, treating all deforested acres proposed for artificial reforestation within 18 years. **Alternative D** would plant an average of 413 acres a year, treating all deforested acres proposed for artificial reforestation within 91 years.

Under **all alternatives**, rates of natural conifer regeneration would be the same. Regeneration occurrence and survival depend upon local site conditions and climate over time. Under **all alternatives**, early development forest lands would need time to grow with periodic precommercial thinning occurring to maintain vigor and facilitate growth into larger size classes. Protection from excessive animal, insect/disease, and fire treatment damage would be necessary.

Climate Change Considerations

Climate change and its impacts on forests would likely affect market incentives for investment in biomass technology and wood-conservation techniques. The market for wood products in the U.S. is highly dependent on the acreage, location, and species composition of forests; supplies of wood; technological changes in production and use of wood; availability of wood substitutes; demand for wood products; and international competition. Rising atmospheric CO_2 would increase forest productivity and carbon storage in forests if sufficient water and nutrients were available. Any increased carbon storage would be in live vegetation. However, in the Southwest and Apache-Sitgreaves NFs, as discussed above, overall production may be limited by decreases in available water. While increases in wildfire may decrease some available wood supply, treatment of wildland-urban interface and restoration of the fire-adapted ecosystems on the Apache-Sitgreaves NFs and elsewhere may increase the overall availability of small diameter timber and related wood products (Joyce et al., 2001).

All alternatives could promote a future sustainable supply of various wood products by moving forested and woodland PNVTs toward desired conditions, which should make these lands more resilient to climate change. By implementing treatments that can reduce losses to drought, insect/disease outbreaks, and high severity wildfires, the alternatives would rank as follows from fastest to slowest restoration rates: **alternative C,** followed by **alternatives D**, **B, and A**.

Multiple socioeconomic impacts often follow drought and severe insect outbreaks. Timber production, manufacturing, and markets may not be able to process large numbers of killed trees. Where insect outbreaks occur, the public often perceives an increased fire risk and less than scenic vistas (Ryan et al., 2008). These factors could drive future public policy.

As increasing tree mortality rates are already underway in relation to these very same climate-related factors, wood markets may be asked to take more dead and charred wood than their enterprises can utilize. **Alternative D**, followed by **alternatives B, C, and A** would create more intentionally fire-killed volume in addition to dead trees already being offered for salvage.

Salvaging and converting biomass into boards, firewood, and other wood products (as a byproduct of forest restoration) could help reduce carbon loss from wildland fire. Another consideration may be to use biomass for bioenergy production. Bioenergy production can be carbon neutral and could replace the fossil fuels in generators. Mobile generation facilities could provide power to schools, hospitals, and command centers in the event of an emergency.

If new markets for forest biomass to generate heat and electricity in place of fossil fuels should develop locally or regionally, then traditional “nonindustrial” wood species and sizes could become more of an “industrial” demand. This trend is already underway. Alternatives offering the most dependable supply of wood volume from both suitable and non-suitable timberlands would provide the most flexibility to meet changing market demands are from greatest to least: **alternative C, B, A, and then D**.

Forest and woodland restoration treatments under **all alternatives** could have positive and negative effects on the land’s ability, within those treated acres, to sequester carbon from the atmosphere. Scientific literature on the role of forests and forest management in carbon storage versus carbon emissions indicates that many complex variables and tradeoffs must be considered. In general, according to Ryan et al., 2010; Huang et al., 2013; North and Hurteau, 2011; Hurteau et al., 2010; North et al., 2009; Hurteau and North, 2009; Finkral and Evans, 2008; and Dore et al., 2010, treatments that prevent deforestation, reforest severely burned forests, retain the majority of large trees, retain soil organic reserves, increase health and growth rates of existing forests and herbaceous vegetation, and convert trees into durable wood products retain and improve carbon storage. Use of biomass energy can reduce fossil fuel carbon emissions. Exhaust from harvesting and industrial operations and from wildland fire treatments would cause immediate carbon emissions. However, these activities can reduce greater pulses of carbon emitted from large stand-replacement wildfires in addition to preventing large scale losses of forests as important carbon sinks. Well-designed restoration thinning and maintenance of tree groups and/or stands to sustainable levels of all tree sizes present should be an important treatment consideration for the site capability, species silvics, and fire regime involved (Fiedler et al., 2010; Dore et al., 2010; Reynolds et al., 2013; Triepke et al., 2011; Hurteau et al.. 2010; Covington, 2000).

Comparing the alternatives for effects to climate change would be speculative since the Forest Service currently does not have the ability to reliably estimate many unknown variables. **All alternatives** would provide direction for projects to retain proper amounts of old growth and large trees/snags/logs; maintain species biodiversity within the species composition appropriate to each PNVT, including improved herbaceous vegetation condition; improve or maintain structural diversity; reduce overstocked stands to improve tree vigor, growth, and health; restore resiliency to uncharacteristic disturbances; and improve resiliency to climatic stressors thus improving the adaptive capacity of forests to climate change.

Cumulative Environmental Consequences

The cumulative effects area for this analysis of forest products is the White Mountains-San Francisco Peaks-Mogollon Rim Ecoregion (see figure 44). This ecoregion includes the Apache-Sitgreaves NFs, most of the Coconino NF, portions of the Prescott and Tonto NFs, the southern end of the Kaibab NF, and all of the Gila NF and portions of the Cibola NF in New Mexico. Non-Forest Service land ownerships in this ecoregion include BLM-managed lands, Arizona and New Mexico state lands, Fort Apache and San Carlos Apache Indian Reservations in Arizona, other tribal lands in New Mexico, and private lands.

Past, present, and foreseeable forest and woodland management actions on Federal and tribal lands which could contribute to cumulative effects are fire suppression and the lack of thinning trees less than 9 inches in diameter that have resulted in an overabundance of small trees with no market value. A similar situation exists on state and private lands.

National forests and State, tribal, and private lands have been unable to institute long-term uneven-aged management practices designed to provide sustainable levels of wood products because markets for small diameter trees have not consistently existed. Management emphasis has focused on short-term fuels reduction at a cost to the land owner.

Wood volumes cut from State and private lands are less likely to impact the total market situation, as their treatments are smaller, widely scattered across the ecoregion, and less likely to provide long-term wood volumes. Tribes typically utilize their cut volumes in their own industries, although they may supply some to local markets. Therefore, the bulk of products available to markets comes from Federal lands.

Future forest/woodland management strategies across all other national forests within the ecoregion are expected to be similar to those proposed for the Apache-Sitgreaves NFs. They are revising their land management plans or intend to revise their plans in the near future. The other national forests and the Apache-Sitgreaves NFs would use the same desired conditions for the forested and woodland PNVTs, with uneven-aged silviculture and the return of fire and other natural disturbances to their natural roles.

The largest foreseeable action is the Four Forest Restoration Initiative (4FRI), for which the contract was recently awarded. This project includes 2.4 million acres on four national forests (Apache-Sitgreaves, Coconino, Kaibab, and Tonto) in northern Arizona, and focuses on restoring the ponderosa pine and dry mixed conifer forested PNVTs (see figure 45). Several of its projects are planned within the ecoregion. The management actions associated with 4FRI projects may be implemented in this planning period. This initiative seeks to develop sustainable markets for wood products from restoring and maintaining desired conditions, which are similar across all four national forests involved.

The 4FRI project could become the major instrument to implement **alternatives A, B, or C** treatments on the ponderosa pine and dry mixed conifer forest lands. It has the potential to become the principal market for the majority of logging operations in north and central Arizona during the planning period.

Alternative D can provide wood volumes during the planning period, but it would fall short of contributing to sustainable markets. It would treat so many more acres exclusively with wildland fire and would cut in several PNVTs outside the 4FRI focus. Therefore, it would limit the harvestable green wood volumes needed to support markets dependent upon 4FRI.

At its high objective level, **alternative C** may be more suited to supply the high volume that 4FRI is expected to demand because the **other alternatives'** cutting volumes may not be high enough. However, **alternative B's** high and low treatment objectives would provide more wood volume to 4FRI than **alternative C's** low objective. The Apache-Sitgreaves NFs are not expected to provide all wood volume to supply this and other markets. When the maximum total annual wood volumes (ASQ plus non-ASQ) proposed for either **alternative B or C** are combined with the annual wood cutting volumes proposed by the Kaibab, Coconino, and Tonto NFs, the total from all four forests should meet estimated market demands.

Alternative A is not expected to provide enough volume for 4FRI because it emphasizes mechanized treatments around communities. Most areas around communities have already been thinned and only require maintenance thinning during this planning period. As a result, harvesting may shift to other national forests for more volume, which could pull operators and contractors away from completing restoration work elsewhere on the Apache-Sitgreaves NFs.

A Forest Service strategy for 4FRI is to discourage Federal payment for tree cutting and removal services, in favor of selling the cut trees at minimal to fair sale values. This shift in strategy could discourage some logging/thinning companies from fully participating and/or reduce the number of sales sold as transportation fuel prices rise. Fewer cutting treatment acres could result and they could be located closer to established markets and/or railroad lines.

Although the proposed plan (**alternative B**) emphasizes addressing the needs of communities at risk of uncharacteristic wildfire, it is not entirely consistent with the community wildfire protection plans (CWPPs) for Apache, Navajo, Coconino, and Greenlee Counties, which were published in 2004 and 2005. These CWPPs include a generic prescription to "thin from 40 to 60 BA, with a 16-inch diameter cap" on Federal lands, which may not move project areas toward desired conditions. As designed, **alternative C** would be inconsistent with such a prescription; while **alternative D** would adopt the 16-inch diameter cap for nearly all cuts. A**lternative A** may continue to use this prescription on many treatment acres. Under **all alternatives**, this generic prescription would not automatically be proposed or used at the project-level. However, the CWPP prescription should be considered as an alternative analyzed in detail under any project proposed under the Healthy Forests Restoration Act of 2003.

See the "Socioeconomic Resources" section for additional cumulative environmental consequences.

Livestock Grazing

This section describes the potential environmental consequences of the alternatives on the rangeland resource. It discusses the forestwide suitability of NFS lands for producing forage for grazing animals and examines the potential consequences on the rangeland resource. The full analysis for livestock grazing can be found in the "Range Specialist Report" (Forest Service, 2014n) available in the "Plan Set of Documents." Additional information can be found in the "Vegetation," "Riparian," and "Invasive Species" sections.

In the analysis for this resource, assumptions include the following:

- The land management plan sets the framework for site-specific determinations relating to allotment management, such as the grazing systems to meet desired conditions and the range developments needed to implement those systems.
- Under all alternatives, allotment-level analysis, including season of use, permitted livestock numbers, and forage use levels occur at the project-level.
- Pest (e.g., invasive plants) problems are evaluated during allotment planning or as issues arise on a site-specific basis.
- Conflict or beneficial interactions among livestock, wild free-roaming horses and burros, and wild animal populations are managed at the allotment/territory level.
- Vegetation treatments contribute to the amount and condition of rangelands. All alternatives provide direction to move rangelands toward desired conditions.

- Livestock grazing, under all alternatives, would be adaptively managed to balance use by livestock, wild horses, and wildlife, with estimated short- and long-term forage production and the effects of climate change.
- Under all alternatives, various activities such as dispersed recreation, firewood gathering, road use, OHV use, and elk grazing may affect the forage resource. The effects from these activities vary depending on their intensity and location. When conflicts arise from these uses that threaten the long-term range condition and trend, the forests would look for multiple-use solutions that balance uses, such as consumption by nonnative species of forage needed by wildlife.

Affected Environment

In the early 1900s, the Forest Service instituted a grazing permit system that required users to pay a fee. The forests were divided into allotments to better control livestock grazing and maintain rangeland productivity. Livestock grazing occurs on NFS lands that are capable and suitable and in every major vegetation type on the Apache-Sitgreaves NFs. The forests currently have 96 active grazing allotments and two sheep driveways covering approximately 1.7 million acres of NFS lands. Grazing on the forests helps to maintain ranching traditions, social customs, and local ranching operations. See the “Socioeconomic Resources” section for the jobs and labor income contributed to local counties from livestock grazing on NFS land.

Most of the active and vacant grazing allotments have been assessed for resource conditions and undergone NEPA analysis to balance permitted livestock numbers with available forage production and to maintain or move toward desired conditions. Management and monitoring are being used to maintain and improve the rangeland resource.

Vegetation Treatments

Rangeland management is affected by the vegetation condition and ongoing vegetation treatments such as removal of encroaching juniper using mechanical treatments and wildland fire. For information on vegetation condition, see the “Vegetation” section.

In the absence of frequent fire or mechanical treatments, woodlands naturally become denser and trees encroach into adjacent grasslands. As junipers and piñons encroach into grasslands, they extract shallow groundwater and deposit leaf litter that generally suppresses herbaceous plant growth, thereby reducing species composition and density of the native herbaceous understory. The encroachment of trees into grasslands reduces ground cover and increases the amount of soil erosion, with the potential of a permanent loss of topsoil (Horman and Anderson, 2003).

In severe stages of tree encroachment, the seed banks of the grasses and forbs can be lost. Because much of the existing, encroached grasslands have been dominated by woody species for the better part of a century, a seed bank of native herbaceous species may no longer exist. This is more the case with piñon-juniper, than in areas with overstocked or encroaching ponderosa pine, since the amount of topsoil lost with encroaching ponderosa pine is generally less due to higher quantities of protective pine needle litter and duff. The result of encroachment is a loss of forage and habitat quality for livestock and wildlife, with a potential permanent loss of topsoil in severe stages of erosion.

The 1987 plan acknowledged the overstocking of juniper and the associated effects on herbaceous understory density and composition. The plan's objectives were to thin juniper overstory and promote a return to grasslands. Over the past 20 years, many areas of grasslands have been treated to reduce tree encroachment.

Riparian Areas

There are approximately 48,000 acres of riparian vegetation types on the Apache-Sitgreaves NFs. Livestock are attracted to areas with water. Cattle, if not actively managed, tend to stay in and graze gentle-gradient riparian areas to an extent that can interfere with attaining the desired vegetation and soil resource conditions. Wetlands, springs, and aspen stands, and their associated wildlife, can be negatively affected by the relatively higher livestock occupancy and use, if not controlled. Current allotment management focuses on strategies to distribute livestock use and impacts to prevent concentration in the riparian areas.

Invasive Plants

Noxious and invasive weeds outcompete and replace the native plant species on which grazing animals and the ecosystem depend. Most weeds have little to no forage value, compared to the native species they have replaced. A heavy infestation by one or more weed species could result in loss of forage for ungulates and habitat for a variety of wildlife.

The forests are not heavily infested with weeds. Most populations are small and scattered, and do not dominate the vegetation community as yet. Therefore, there is very little current effect on forage levels for livestock or wildlife from noxious or invasive weeds.

Heber Wild Horse Territory

The Heber Wild Horse Territory (territory) on the Black Mesa Ranger District comprises approximately 19,700 acres. It is located in the Black Canyon area southwest of Heber-Overgaard, Arizona. The territory was established in 1973, based on the location of a known band of horses, under the Wild Free-Roaming Horse and Burro Protection Act of 1971 (the act). The purpose of the act is to establish territories for use by, and for, the protection of wild horses, in numbers harmonizing with the environment.

The 1987 plan does not contain specific goals or objectives for the territory. However, it does contain a standard and guideline that states "Maintain existing wild horse territory and herd." Direction for its management will be contained in the site-specific "Heber Wild Horse Territory Management Plan," which is currently under development and environmental analysis.

Environmental Consequences of Alternatives

All alternatives would provide similar guidance for managing livestock grazing and include balancing livestock grazing with available forage.

Lands Capable and Suitable for Livestock Grazing

Provisions of the 1982 Planning Rule require that the capability and suitability for producing forage for grazing animals on NFS lands be determined. Capability is the potential of an area of land to produce resources and supply goods and services. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices.

The capability of the lands on the Apache-Sitgreaves NFs to produce forage for grazing animals was determined in the 1980s during the first round of forest planning. Landscape scale conditions that determine capability have not changed significantly since the first evaluation.

Suitability is the appropriateness of applying certain resource management practices to a particular area of land, in consideration of relevant social, economic, and ecological factors. A unit of land may be suitable for a variety of individual or combined management practices.

The criteria for suitability for livestock grazing would be the same in all **action alternatives** (see chapter 4 in the proposed plan). This is very similar to the existing direction (**alternative A**) under the 1987 plan. The acres suitable for livestock grazing in the **action alternatives** would be very similar. The only variation among the **action alternatives** corresponds to the amount of land allocated to the Recommended Research Natural Area Management Area which is considered not suitable. In **alternatives B and C** land would be allocated to five recommended RNAs; while there are only three recommended RNAs in **alternative D**. Table 152 identifies the acres that are suitable for livestock grazing by alternative (see figure 75 through figure 80).

Even though the amount of land suitable for livestock grazing varies slightly by alternative, there would be no anticipated impact on permitted animal unit months (AUMs) in **all alternatives**. The alternatives would continue to provide for continued availability of forage for domestic livestock and opportunities for ranching lifestyles consistent with the other desired conditions.

Table 152. Acres and percent of NFS land suitable for livestock grazing by alternative

Alternative A	Alternative B	Alternative C	Alternative D
1,931,951 (96%)	1,901,512 (94%)	1,901,512 (94%)	1,903,116 (94%)

Under **all alternatives**, livestock grazing on the Apache-Sitgreaves NFs would potentially be affected by other Forest Service activities, such as mechanical treatments, prescribed fire, noxious and invasive weed management, and special designations. Effects of these other activities are described in more detail below. As a result, under **all alternatives,** adjustments in season of grazing, grazing intensity, kind and class of livestock, or type of grazing system may occur after a site-specific analysis.

Additionally, livestock grazing may be affected by competition or conflict with other resource users (e.g., recreation, wildlife) or through the need to protect other resources such as soils, vegetation, and wildlife habitat.

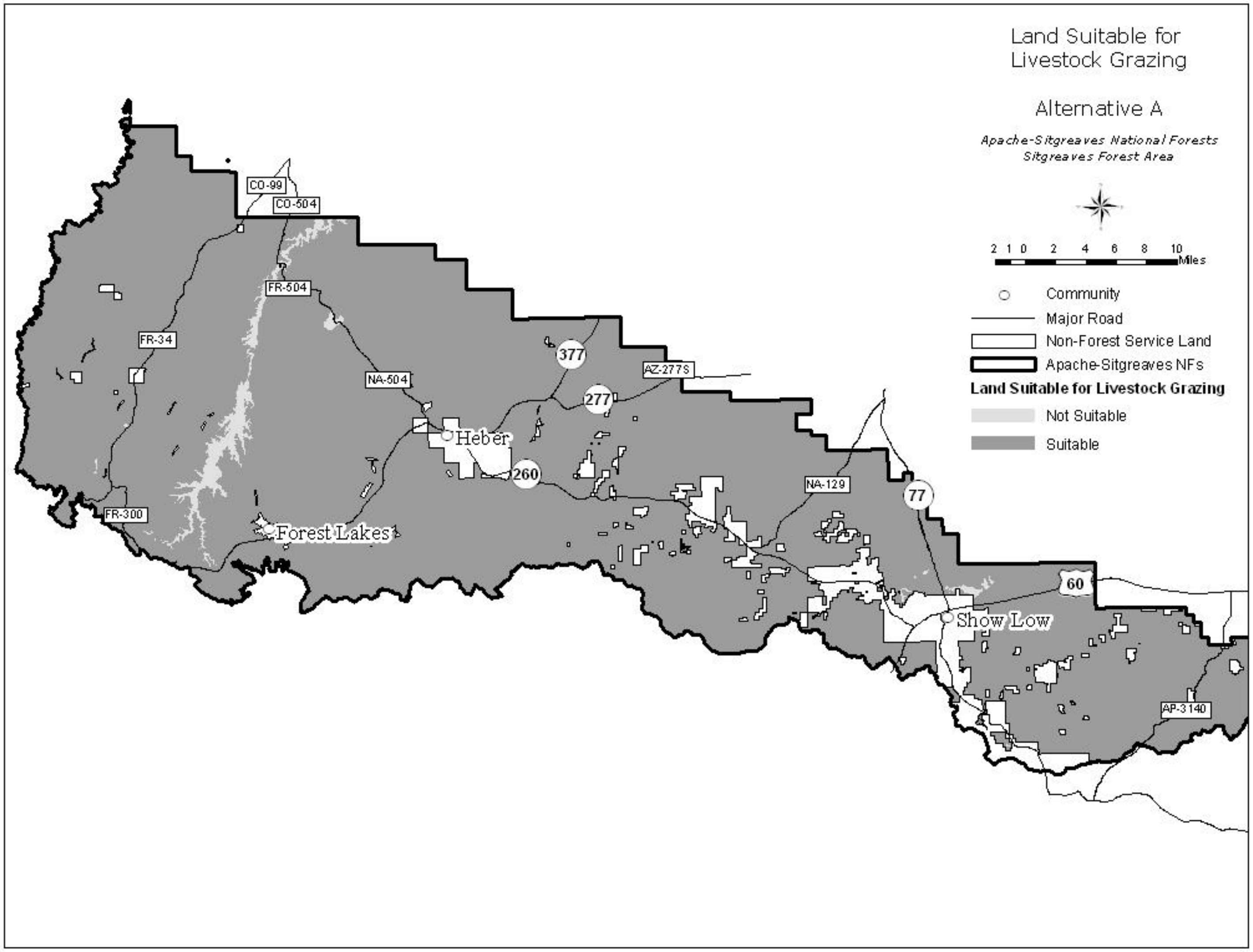

Figure 75. Map of land suitable for livestock grazing, alternative A – Sitgreaves NF

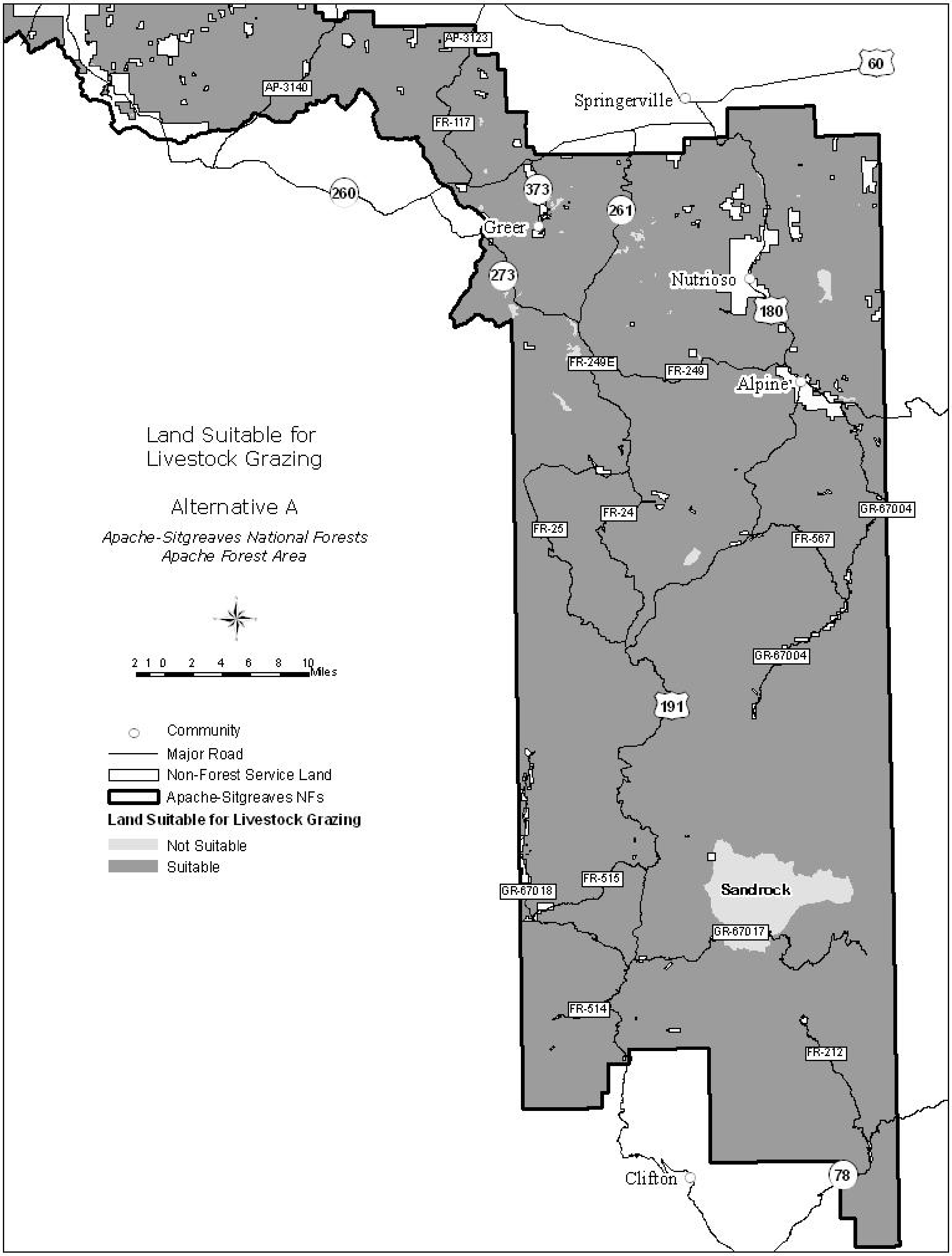

Figure 76. Map of land suitable for livestock grazing, alternative A – Apache NF

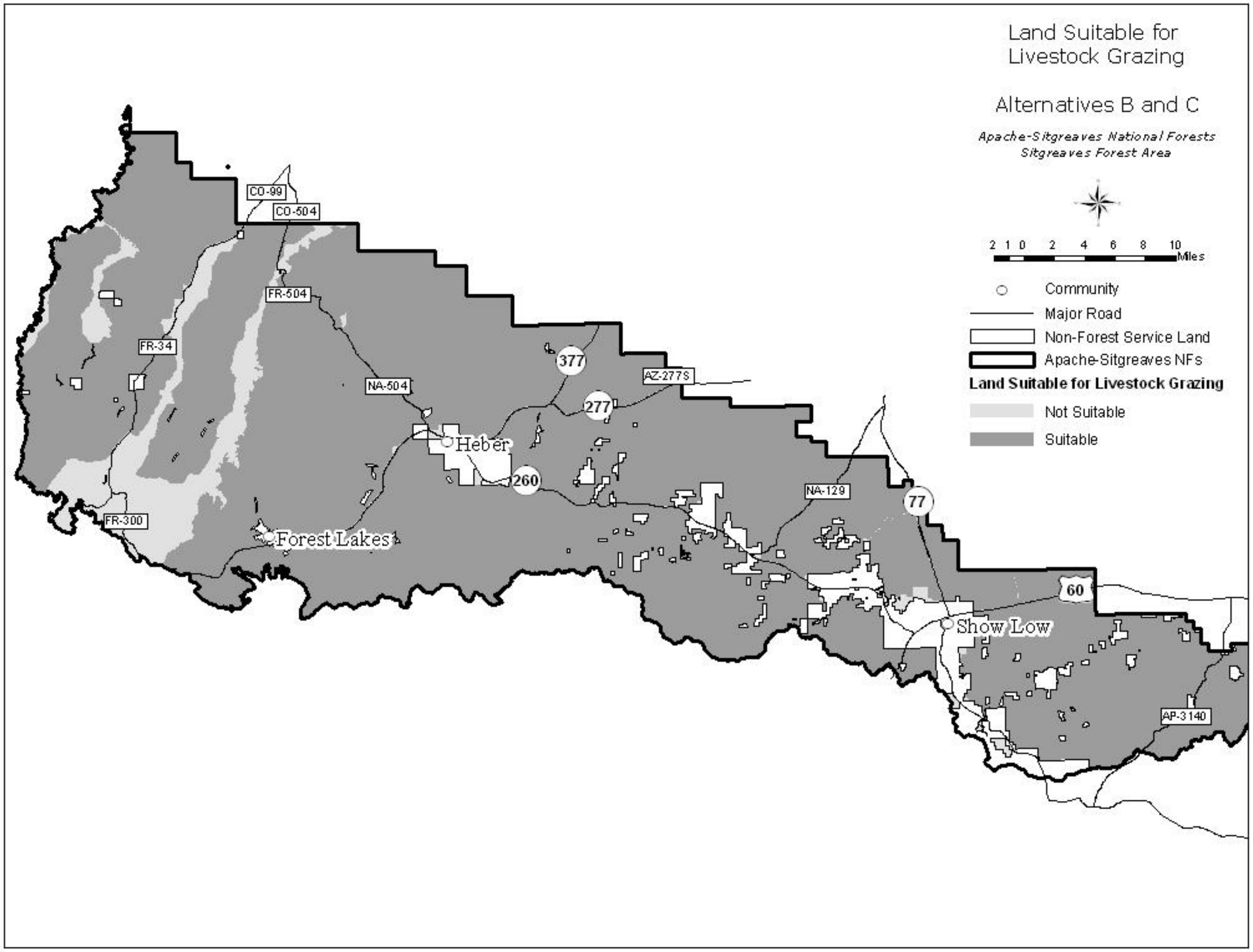

Figure 77. Map of land suitable for livestock grazing, alternatives B and C – Sitgreaves NF

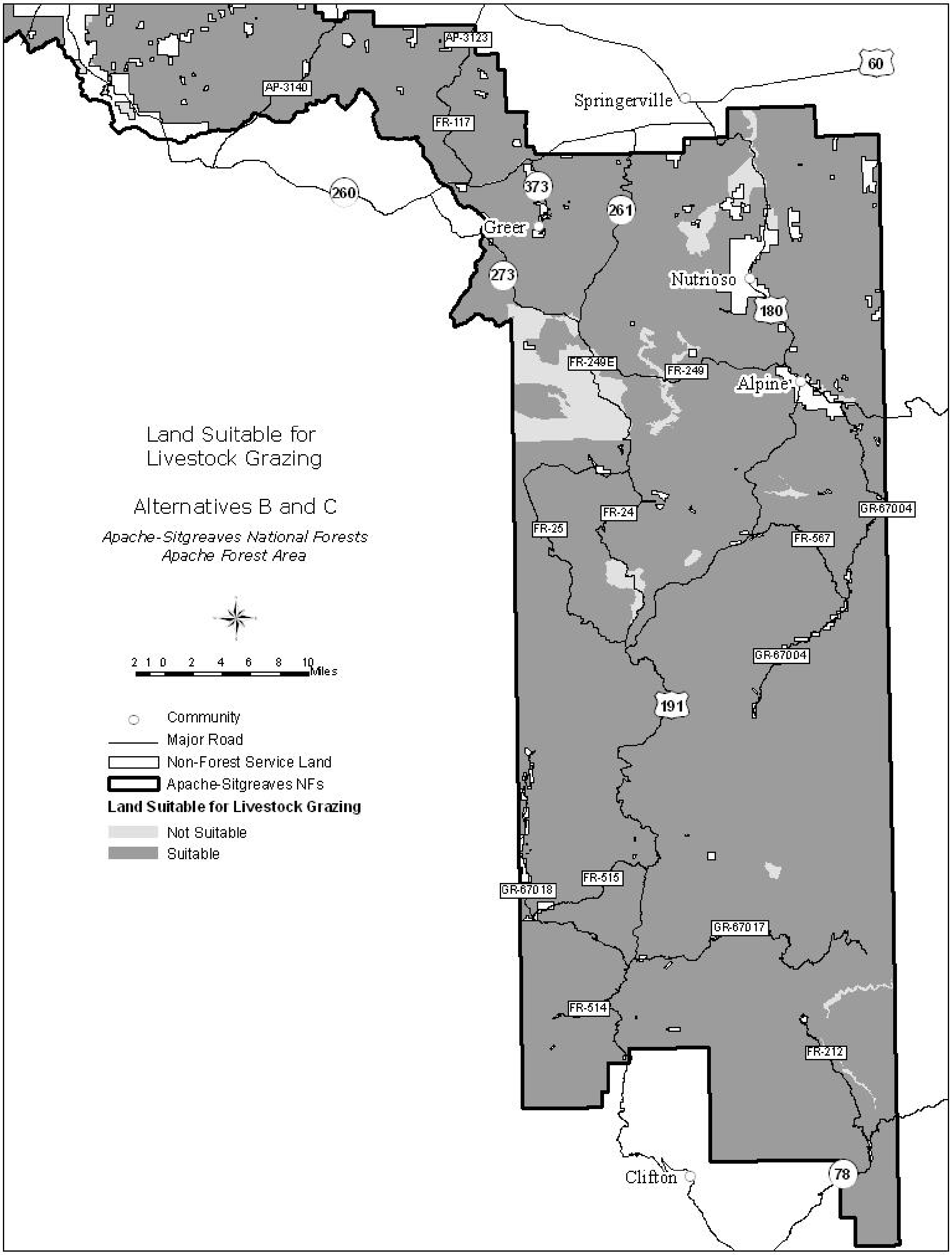

Figure 78. Map of land suitable for livestock grazing, alternatives B and C – Apache NF

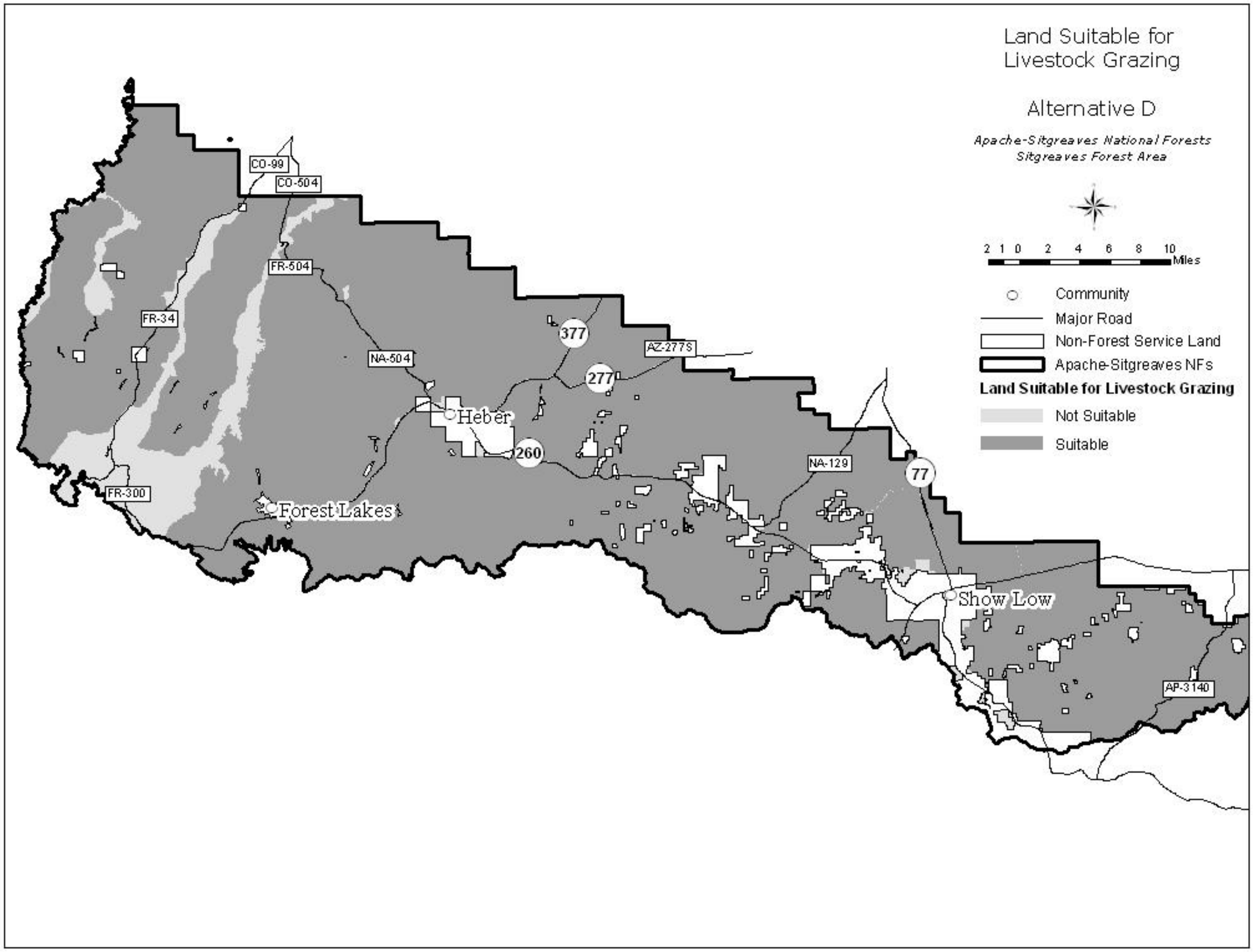

Figure 79. Map of land suitable for livestock grazing, alternative D – Sitgreaves NF

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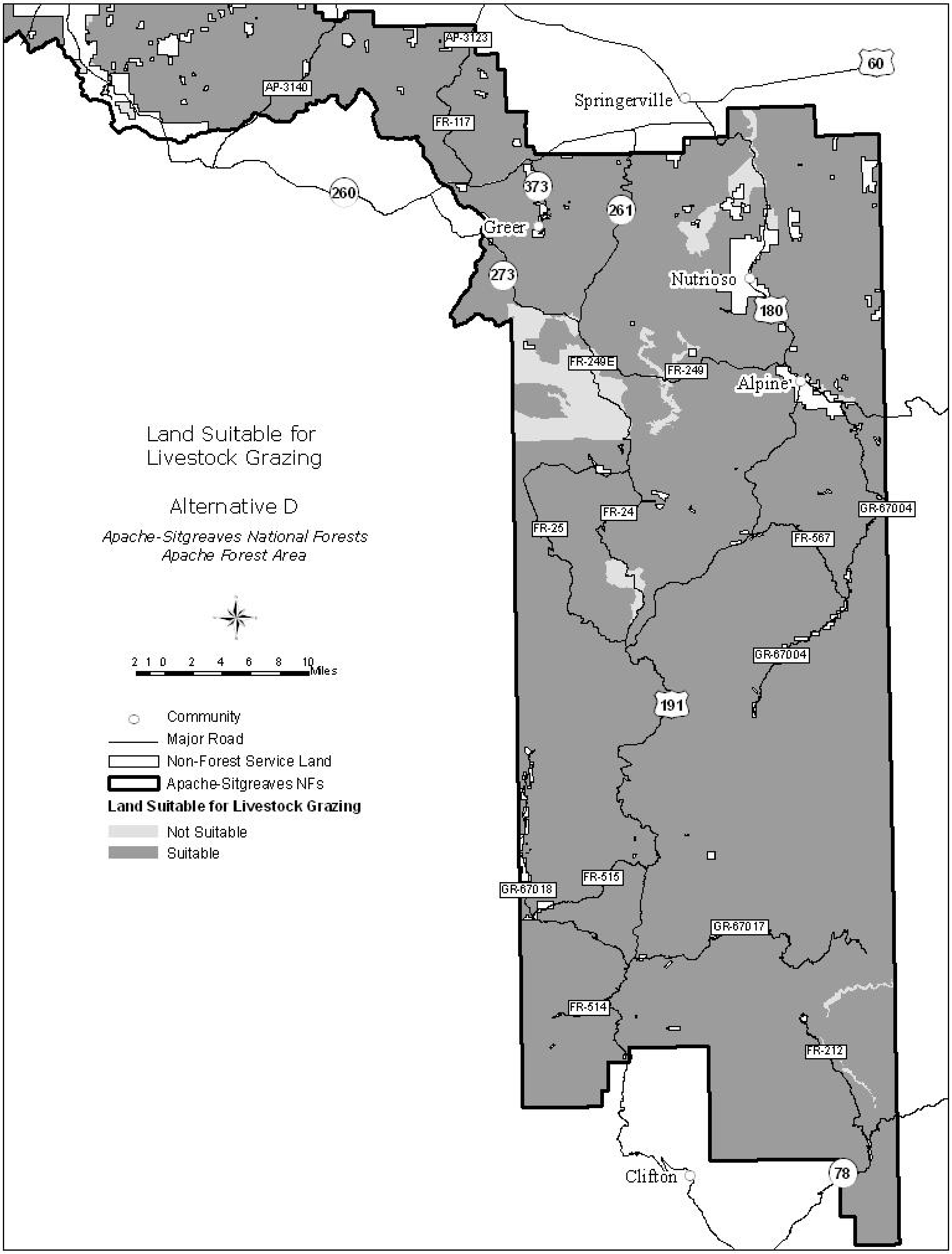

Figure 80. Map of land suitable for livestock grazing, alternative D – Apache NF

Vegetation Treatments

Woody Species Reduction

Table 153 displays the average planned treatment (mechanical and wildland fire) objectives in woodlands and grasslands on an annual basis. The **action alternatives** would have more average annual mechanical treatments than **alternative A**.

Table 153. Woody species reduction treatments in both woodland and grassland PNVTs by alternative

Treatments	Alt. A	Alt. B	Alt. C	Alt. D
Average Acres Treated in Woodland PNVTs Per Year	2,276	9,931	6,133	17,396
Average Acres Treated in Grassland PNVTs Per Year	568	18,202	500	18,121
Average Yearly Total By Alternative	**2,844**	**28,133**	**6,633**	**35,517**

By removing trees in woodlands and grasslands, the resulting open canopy would promote understory herbaceous plant growth. The understory vegetation would benefit from reduced competition with trees and would increase in vigor, expand its basal and canopy cover, and deposit seeds that could sprout into new plants and result in improved forage conditions and ground cover. Seed banks in woodlands and grasslands may be lost due to erosion; this could be mitigated by seeding the treated areas. **Alternatives D and then B** would provide the greatest benefit to rangeland condition since the most acres are treated, followed by **alternatives C** and **A**.

Mechanical Vegetation Treatments

Under **all alternatives**, mechanical vegetation treatments would have little effect on overall livestock operations. In the near to mid-term, up to 20 years from treatment, mechanical vegetation treatments and their associated prescribed burns open up the tree canopy and allow more light and water for herbaceous plants to grow. This increases the available forage for grazing animals, improves watershed characteristics through increased ground cover, organic matter, and plant diversity (Bates et al., 2000). The increase in forage would improve livestock distribution in pastures, reduce impacts on use on other areas such as meadows, and improve rangeland conditions.

Follow-up treatments would be needed to maintain the reduced tree canopy. Otherwise, areas would revegetate with trees and lose the herbaceous component that had developed, thus reducing the amount of forage available for domestic livestock. For more information on overstory and herbaceous understory cover relationship, see the “Vegetation” section.

Thinning may restore dry springs because of the removal of live trees; trees that would otherwise extract shallow groundwater before it can come out in the springs.

Mechanical treatments have the potential to introduce or encourage the spread of noxious weeds. Vehicles transport seeds and expose soils, and tree removal increases light availability. In some cases, the weed seeds may have been dormant in the soil for decades; the disturbance from equipment and increased sunlight encourages seed sprouting. A weed infestation could result in the loss of the area as a forage base for ungulates and as habitat for wildlife, insects, and native plants. However, the risk of weed infestation would be limited under **all alternatives** because there is direction in law, policy, and regulation to contain, control, and eradicate invasive species and areas would be reviewed to mitigate the potential emergence of invasive species.

Fire

Fire removes forage available to livestock in the short term until plants regrow, usually until the next season. Grazing management can be affected by wildland fire and may need to be adjusted by changing pasture rotations, livestock numbers, or livestock season of use.

After any prescribed burn or wildfire, the area would be evaluated for ground cover and condition, plant composition, infrastructure (e.g., fencing), presence of noxious and invasive weeds, and forage production before livestock are authorized to graze.

Wildland fire would be planned in **all alternatives**; however, there is not a direct correlation between the amount of wildland fire and burned pastures and the need to defer livestock grazing. There are times following fire, based on an evaluation of resource condition, that a pasture may be temporarily unavailable to livestock grazing, which may in turn impact the permittee.

In the near to mid-term, up to 20 years from treatment, wildland fire would open up the tree canopy and allow more light and water for herbaceous plants to increase and establish. This would increase available forage for grazing animals mostly in upland areas. However, this may be temporary, unless follow-up treatments occur that would maintain the reduced tree canopy. Without maintenance, it is likely that treated areas would gradually revegetate with trees and lose the herbaceous component that had developed.

The increased herbaceous cover may not lead to noticeable increases in authorized or permitted livestock AUMs because forage in upland areas is often underused when compared to the areas along streams and meadows, which control how long and how many livestock can graze in a pasture without adverse impacts to those areas.

Wildland fire may restore dry springs because of the removal of live trees; trees that would otherwise extract shallow groundwater before it can come out in the springs. This effect is much less likely with low severity fires than with high severity fires because fewer trees are killed.

Riparian Areas

In **all alternatives**, the impact of livestock grazing on riparian habitat would be analyzed in site-specific NEPA analyses, as needed. If desired conditions cannot be achieved through grazing management practices (e.g., herding, grazing deferment), then livestock exclosures may be necessary around wetlands, cienegas, and riparian areas.

Exclosures areas would likely not be available for forage, but they would not be big enough to reduce stocking rates in a pasture. The need for water at exclosures would be mitigated with alternative water sources, such as providing lanes to the water, piping to livestock drinkers, or other techniques.

Invasive Plants

Increased abundance of invasive weeds would reduce the quality of forage by displacing native species and altering nutrient and fire cycles, degrading soil structure, and decreasing the quality and availability of forage for livestock and wildlife (Mack et al., 2000).

Although the 1987 plan (**alternative A**) provided no direction to manage invasive species, the forests actually began to actively manage invasive plants in the mid-1990s. All of the **action alternatives** would provide specific direction to contain, control, and eradicate invasive plant species.

In **all alternatives**, noxious and invasive weed populations would be treated before they can dominate areas, and they would, therefore, not affect forage levels. However, the spread of invasive plants into grazing allotments could result in the temporary closure of affected rangelands in order to expedite treatment and eradication measures. Treatment should result in control of the invasive plants and improvement of the degraded rangeland.

Heber Wild Horse Territory

All alternatives would manage the territory according to the territory management plan currently being developed and analyzed. The only difference between **alternative A** and the **action alternatives** is that they would recognize the territory as a separate management area. The environmental consequences to the forage resource in the Heber Wild Horse Territory would be similar to other areas of the forests (see other parts of this “Livestock Grazing” section).

Climate Change

There may be environmental consequences associated with climate change. Warmer and drier conditions could result in changes in vegetation patterns (Westerling, 2006; Millar, 2007); decreases in overall forest productivity (Forest Service, 2008e); decreases in water availability; and greater vulnerability to invasive plants. These conditions would decrease forage availability and shorten the season for livestock grazing. Unlike **alternative A**, the **action alternatives** provide guidance (e.g., invasive species treatments) for preventative and adaptive measures that respond to climate change.

Cumulative Environmental Consequences

The area for this level of analysis includes adjacent national forests, Bureau of Land Management, State, tribal, and private land. It is reasonably foreseeable that livestock grazing would continue on these lands. Vegetative treatments (primarily wildland fire and mechanical) are also expected to occur on these adjacent lands. These types of treatments would increase forage for livestock and improve rangeland condition. **All alternatives** would be expected to cumulatively contribute to this increase in forage availability based on the planned vegetation treatments.

An effect associated with mechanical treatments and livestock grazing is the potential to spread invasive species from adjacent lands. New weed populations could occur from vehicle-transported seeds and increased light availability following mechanical treatments or creation of seedbeds by livestock use. Livestock and wildlife can bring in weed seeds, but livestock use results in fewer new weed populations than those established along roads and trails by seeds spread by vehicle tires, equipment tracks, and/or attached soil (Tyser and Worley, 1992; Tyser and Key, 1988; Gelbard and Harrison, 2003). **All alternatives** would contribute similarly to the control, treatment, and eradication of invasive plant species introduced from outside the forests.

Fires from adjacent lands can escape and spread onto the Apache-Sitgreaves NFs. If they do, it could lead to temporary grazing exclusions and impact ranching operations by requiring the permittee to find new forage or sell all or part of the livestock.

See the “Socioeconomic Resources” section for additional cumulative environmental consequences.

Minerals and Energy

This section describes the environmental consequences of minerals and energy resources development from implementing the alternatives. It compares how each alternative varies in its emphasis of mineral and energy activities and development by comparing the amount of land that is or may be withdrawn from mineral entry. Information related to special use permits and energy corridors and developments can be found in the “Lands and Special Uses” section. The full analysis for minerals and energy can be found in the “Minerals and Energy Specialist Report” (Forest Service, 2014m) available in the “Plan Set of Documents.”

In the analysis for this resource, assumptions include the following:

- The Forest Service has the personnel and funding capacity to screen, process, and administer mineral activities.
- The economy will fluctuate and influence mineral exploration.
- There are no known leases on the forests for the following leasable mineral resources: oil and gas, oil shale, coal, or geothermal. Should valid leasable mineral proposals be submitted, the Forest Service would respond as a cooperating agency when requested by the BLM, which acts as the lead agency for subsurface mineral extraction. Therefore, the effects to leasable minerals were not analyzed.

Affected Environment

Minerals

Individuals operating under U.S. mining laws have a statutory right (General Mining Law of 1872) to enter NFS lands to locate and develop mineral resources. Mineral resources on federally owned lands are separated into three categories by statutory and regulatory direction: locatable, leasable, and mineral materials (salable). Mineral activity fluctuates with consumer demand and prices. The currently high prices (GoldPrice, 2011) for many minerals could make exploration and development more economical. Mineral resource activity on the Apache-Sitgreaves NFs has historically been low. Mineral activity is presently concentrated in a few scattered areas. Commodity use and production have shown declines from the past. However, these forest uses contribute to sustaining the lifestyles and traditions of local communities.

The following sections discuss locatable and salable minerals. The potential for locatable and leasable minerals on the Apache-Sitgreaves NFs is low because of the existing geology.

Locatable Minerals

Locatable minerals are those valuable deposits subject to exploration and development under the General Mining Law of 1872 (as amended). Examples of locatable minerals include, but are not limited to, iron, gold, copper, silver, lead, and zinc. The public has a statutory right to explore for, claim, and mine mineral deposits found on federally owned lands subject to U.S. mining laws. Through a memorandum of understanding with the BLM, the Forest Service administers most aspects of operation under the General Mining Law of 1872 on NFS lands. The Forest Service responds to future operating plans for valid locatable mineral development as they are submitted. Proposals for development of discoveries would likely be infrequent since there are a limited number of claims on the forests. A large copper deposit and open pit copper mine exist just south of the forests' boundary near Morenci, Arizona.

There are three types of locatable mining claims found on the Apache-Sitgreaves NFs: lode, placer, and mill sites. Mining claims may vary in size, but there are maximum size limits by type of claim (BLM, 2008):

- **Lode:** 1,500 feet by 600 feet or approximately 21 acres.
- **Placer:** 20 acres per person with a maximum of 160 acres for an association of eight or more persons.
- **Mill site:** 5 acres.

Table 154 displays the number of active mining claims on the forests.

Table 154. Number of active mining claims on the Apache-Sitgreaves NFs (Forest Service, 2009b)

County	Ranger District	Placer Claims	Lode Claims	Mill Site Claims
Apache	Springerville	1	7	0
Coconino	Black Mesa	8	0	0
Greenlee	Clifton	173	199	12
Navajo	Lakeside/Black Mesa	34	0	0

A mining claimant on NFS lands is required by 36 CFR § 228, Part A, to file an operating plan or notice of intent for proposed mining activities that includes the name and address of operators, a sketch or map of the location, descriptions of operations, access timing, operating period, and environmental protection measures. The Apache-Sitgreaves NFs works with claimants to assure that standards and guidelines in the land management plan are met. The operating plan requires an environmental analysis and decision before the plan is approved.

There is minimal mining activity on the Apache-Sitgreaves NFs. Mining employment occurs on non-NFS lands adjacent to the forests near Clifton, Arizona.

Mineral Activity

The potential for locatable minerals on the Apache-Sitgreaves NFs is low because of the existing geology. The following minerals (table 155) may be found in the counties where the Apache-Sitgreaves NFs are located: Apache, Coconino, Greenlee, and Navajo in Arizona.

Table 155. Minerals that may be found on the Apache-Sitgreaves NFs (Galbraith and Brennan, 1970)

County	Ranger District	Mineral
Apache	Alpine/Springerville	Cobaltite, Erythrite (Cobalt Bloom)
Coconino	Black Mesa	Manganese oxide, Dolomite
Greenlee	Clifton	Gold (lode, placer), Copper, Chalcocite, Sphalerite, Chalcopyrite, Covellite, Pyrite, Molybdenite, Cuprite, Tenorite, Pyrolusite, Magnetite, Fluorite, Magnesite, Smithsonite, Coronadite, Cerussite, Dolomite, Malachite, Azurite, Gerhardtite (Chase Creek Canyon), Gypsum, Chalcanthite, Melanterite, Epsomite, Goslarite, Brochantite, Antlerite, Alunite, Spangolite, Cyanotrichite, Crocoite, Libethenite, Vanadinite, Pyroxene, Tremolite, Garnet, Willemite, Zircon, Dioptase, Epidote, Hemimorphite, Glauconite, Serpentine, Kaolinite, Nontronite, Chrysocolla
Navajo	Lakeside/Black Mesa	Gypsum

Additional exploration for locatable minerals would most likely be limited. Active mining claims for locatable sandstone are located on the Lakeside Ranger District (six to eight separate claimants) and two separate claims on the Black Mesa Ranger District. Each claimant operates under an approved plan of operations. Mining claims on the Clifton Ranger District (Greenlee County) are generally associated with the adjacent private copper mining operations. There are no known abandoned mines on Apache-Sitgreaves NFs lands that would require closure. A number of small abandoned surface operations and test pits are scattered across the forests and are not regarded as hazardous.

Mineral Withdrawals

Mineral withdrawals are under the authority of the 1872 Mining Law for the purpose of limiting activities in order to maintain other public values in the area or reserve the area for a particular public purpose or program. A withdrawal is the withholding of an area from application of the general land laws such as prohibiting the filing of new mining claims in an area. Designated wilderness is withdrawn from mineral entry in the enabling legislation. The Forest Service may request withdrawal of areas from mineral activity if the activity might conflict with other management objectives. Mineral entry withdrawals are generally initiated for administrative sites, developed public recreation areas, and areas highly valued by the public, such as scenic corridors. The 1987 plan identified several management areas that may be withdrawn from mineral entry, but no action has been taken to withdraw those areas.

Currently, 46,604 acres or 2.3 percent of the Apache-Sitgreaves NFs are withdrawn from locatable mineral entry. These withdrawals include wilderness, the Phelps Cabin Research Natural Area (RNA), Phelps Cabin Botanical Area, highway corridors, reservoirs, recreation areas, administrative sites, and developed campgrounds.

Salable Minerals

Salable mineral (also known as common variety mineral) materials are generally low-value deposits of sand, clay, and stone used for building materials and road surfacing. Extracting these materials from NFS lands is at Forest Service discretion. The major statutes pertaining to salable minerals are the Minerals Materials Act of 1947, Surfaces Resources Act of 1955, and the Federal Highways Act of 1956.

The Apache-Sitgreaves NFs have lands that are potential sources of sand, gravel, landscape rock, cinders, and crushed rock. There are also off-forest sources to meet private needs. The demand for common variety mineral materials from the Apache-Sitgreaves NFs is currently low. Permitted uses are predominantly small private sales from common use pits, a multi-operator commercial pit, and various pits for State and county road uses, primarily for road cinders and/or gravel.

The 1987 plan does not allow permitting of mineral material activities in Management Area 14-Black River (Mainstem), Management Area 15-West Fork Black River, Management Area 16-Chevelon Canyon, and Management Area 17-East and West Forks Little Colorado River. Also, no streambed alteration or removal of mineral materials is allowed if it significantly affects riparian-dependent ecosystems, channel morphology, or streambank stability.

Mineral Activity

Sales of mineral materials have varied considerably. In FY2006, 18,400 tons were sold for $9,660 (USGS, 2006); while 38,600 tons were sold for almost $21,000 in FY2009 (Forest Service, 2010c). Free use permits were issued for 25,300 tons in FY2006. The Forest Service uses materials for routine maintenance of NFS roads; some rock crushing occurs for project-specific needs. In FY2006, the Forest Service used almost 500,000 tons of mineral materials. These uses are expected to continue. There may be additional pressure for mineral materials as non-NFS lands adjacent to the forests are developed.

An increase in demand of common variety minerals could be expected as road construction and maintenance occurs on and around the forests. The demand for gravel may increase as campgrounds, forest roads, and county roads are improved. Increased work associated with Federal and State highway construction, reconstruction, and maintenance may increase the demand for construction materials, and the forests may be obligated to provide material under the Title 23, Section 317 of the Federal Highways Act.

Leasable Minerals

There are minimal extractable (leasable) resources on the Apache-Sitgreaves NFs. Potential for geothermal development is limited as only small areas are underlain by thermal waters. A small coal bed is located along the forests boundary north of Pinedale, but it has not been developed. There are no known oil and gas resources.

There are no current leases for oil and gas, geothermal, or coal on the Apache-Sitgreaves NFs.

Energy

Solar energy potential is high and future development would be related to demand. Wind potential is low because of sporadic winds and the terrain (Forest Service, 2009b). There may be a need for additional energy corridors or developments (e.g., electric transmission lines, pipelines, wind turbines) because of the expected demand for electricity to serve the growing populations of Arizona and the Southwest and to provide reliable and consistent services. As communities expand and as non-NFS lands surrounded by NFS lands are developed, distribution lines may be proposed to provide electric services. Energy corridors and energy development (infrastructure) are discussed in the “Lands and Special Uses” section.

Environmental Consequences of Alternatives

Minerals

Under **all alternatives**, decisions regarding mineral activities on the forests would align with law, regulation, and policy and would be consistent with plan decisions for other resource areas (e.g., cultural resources, wildlife).

Under **all alternatives**, mineral activities may have adverse environmental consequences on some resources in the short term and long term. Short-term environmental consequences could include increased human activity, such as motorized traffic, noise from construction equipment, temporary roads, ground disturbance during exploration activities, and construction of the authorized facilities.

Long-term environmental consequences could include operation and maintenance of the authorized facilities over the life of the facility. Operation and maintenance activities may include increased human activity and noise, motorized vehicle traffic, or additional ground disturbance. Determination and implementation of mitigation measures and design may lessen environmental consequences.

Over the long term, the greater public and communities should benefit from services provided by mineral activities. Authorizations that are for a long-term commitment (more than 5 years) and permit some type of construction or extractive activity or alter the landscape would encumber NFS lands for the terms of the authorization and most likely for the foreseeable future. Few authorized constructed features are fully removed or the landscape is not fully rehabilitated.

If locatable mineral extraction occurs during plan implementation, it would result in an irreversible commitment of the resource because it consumes nonrenewable minerals.

Locatable Minerals

Effects to locatable minerals would be limited to the different amounts of land that could be withdrawn from mineral entry in **all alternatives**. There would be no effects to existing mineral claims. The effects to future locatable mineral activities are described in the section below.

Mineral Withdrawals

The current areas that are withdrawn from mineral entry would be carried forward in **all alternatives**. This would equate to 46,604 acres not being available for mineral location and development. Because of the low mineral potential of the forests and the very small amount (2.3 percent) of the forests withdrawn from mineral entry, there would no effects to mining claim location and development.

Recommended wilderness (table 156) would be withdrawn from mineral entry if congressionally designated as wilderness. Recommended RNAs (table 156) may be withdrawn if they are administratively designated. **Alternative A** would have no effect on mining claim location and development because no additional lands would be withdrawn from mineral entry. **Alternatives B and C** would generally have little to no effect on mining claim location and development because of the low mineral potential of the forests and the very small percentages (3 percent or less) of the forests that could be withdrawn. **Alternative D** could have the most effect on future locatable mineral activities because almost one quarter of the forests could be withdrawn which would result in less ground disturbance and fewer effects to resources.

Table 156. Acres that could be withdrawn from mineral entry in the future

Management Area	Alt. A Acres (percent of forests)	Alt. B Acres (percent of forests)	Alt. C Acres (percent of forests)	Alt. D Acres (percent of forests)
Recommended RNA	1,329[a] (<1%)	7,814 (<1%)	7,814 (<1%)	5,957 (<1%)
Recommended Wilderness	0 (0%)	7,074 (<1%)	6,982 (<1%)	681,580 (34%)
Total	**1,329 (<1%)**	**14,888 (<1%)**	**14,796 (<1%)**	**687,537 (34%)**

[a] Acreage from the 1987 plan. Does not include recommended Escudilla RNA, because the area is within Escudilla Wilderness.

Salable Minerals

Alternative A would allow the development of new common variety mineral sources where economic considerations permit and where scenic resource objectives can be met, except in four identified management areas. **Alternative A** would have the most lands available for mineral material permitting. The **action alternatives** would limit common variety mineral activities in designated and recommended special areas (e.g., RNAs, wilderness, eligible and suitable wild and scenic rivers, national recreation trails, scenic byways) and Chevelon Canyon. **Alternatives B and C** would have less land available than **alternative A**. The least land would be available in **alternative D** because of the amount of land in the Recommended Wilderness Management Area. The effects to resources would be least in **alternative D** because of less ground disturbance. **Alternatives A, B, and C** would have more lands available to respond to public demand for mineral materials than **alternative D**.

Energy

There would be little to no effects to extractive energy resources in **all alternatives** because of the very limited amount of these resources on the Apache-Sitgreaves NFs.

Cumulative Environmental Consequences

The area for this level of analysis includes those lands adjacent to the Apache-Sitgreaves NFs. There are no known cumulative environmental consequences associated with minerals and energy development on the Apache-Sitgreaves NFs. There may be requests for transmission corridors due to energy development on adjacent lands. See the “Lands and Special Uses” section for a discussion of the potential consequences.

Socioeconomic Resources

This section provides social and economic analysis, including past and current conditions and the potential consequences of the four alternatives on the social and economic environment.

The earliest inhabitants of the area comprising the present-day Apache-Sitgreaves NFs and surrounding lands trod lightly upon the land at least 13,000 years ago. They followed the migrating mammoth and later the buffalo, leaving only spear points to mark their presence. As early as 2,000 years ago, the Ancestral Puebloans arrived and shared the White Mountains with the Mogollon people already there. By the time the Apache, Navajo, and Yavapai arrived in the 1400s, the Puebloans were gone. After the mid-1500s, the Spanish continued a modest forest use, although they used the forests for fuel, structures, and fence posts more than the Native Americans did.

From 1821 to 1848, the Mogollon Rim forests were part of the Republic of Mexico. When the United States acquired the territory from Mexico, those lands became a part of the “public domain” if they were not owned by private individuals, including earlier Spanish and Mexican land grants. The land was opened under various laws to settlement, purchase, and use. Only after the American Civil War and the completion of the railroads did a great change in public land use begin in Arizona. Domestic enterprises like cutting timber, mining, and raising cattle were to become corporate enterprises with national and international markets.

The territory of Arizona urged the sale of all of the territorial timberlands at public auction in 1879. In 1880, Congress authorized the citizens of Arizona to “fell and remove timber from the public domain for mining and domestic purposes.” Timber production in Arizona and New Mexico, estimated at 8 million board feet in 1879, rose to 22 million in 1889 and 67 million in 1900. Cattle grazed on the forests’ open ranges in ever greater numbers, increasing from 172,000 head in 1880 to 1.5 million by 1890. In 1891, Congress authorized the President to designate particular areas of forested public domain as “reserves,” to be set aside for future use. The reserves were, by law, completely closed to public use and there was no management or supervision of the land. Congress restricted the President’s authority in 1897, authorizing him to establish reserves only to preserve timber, protect watersheds, and provide lumber for local use.

On August 17, 1898, the Black Mesa Reserve (North and South) was established. By 1900, once lush grasslands could no longer support large numbers of livestock. It was becoming painfully clear to Southwesterners that the renewable and nonrenewable resources of the Southwest were being depleted. The Secretary of Agriculture announced in 1905 the transfer of the Forest Reserves to the Department of Agriculture, as authorized by Congress. Some 21 million acres of public lands, almost one-eighth of the land area of Arizona and New Mexico, were now to be administered by a regional subdivision of the Forest Service. The Forest Service was charged to maintain the permanence of national forest resources, while providing for their use. In 1907, Black Mesa Reserve was made a national forest with its headquarters in Show Low, Arizona. In 1908, Theodore Roosevelt established the Sitgreaves NF from parts of the Black Mesa North Reserve and Tonto NF. The Apache NF was established the same year from portions of the Black Mesa South Reserve and other neighboring forest reserves.

Arizona’s population increased dramatically following World War II, but little changed in the rural communities surrounding the Apache and Sitgreaves NFs. Logging, grazing, and mining were important economic factors in the local communities and the forests provided employment where few jobs were available. In 1974, the Apache NF was combined administratively with the Sitgreaves NF to become the Apache-Sitgreaves NFs.

The study areas for the economic analysis are consistent with the areas defined in the “Economic and Social Sustainability Assessment” (Forest Service, 2009a). Affected environment analysis uses all of Apache, Coconino, Greenlee, and Navajo Counties in Arizona and Catron and Grant Counties in New Mexico. The environmental consequences analysis uses zip code-level data to better capture the economic links between the forests and the surrounding communities. The northern sections of Apache and Navajo Counties and most of Coconino County are excluded from the environmental consequences analysis due to their physical distance from the forests. The forests’ land base lies in the Arizona counties; however, the New Mexico counties were also included because of use patterns and economic trade flows. Table 157 reports the number of Apache-Sitgreaves NFs acres by county.

Table 157. Apache-Sitgreaves NFs acres by county

County, State	Acres
Apache County, AZ	493,481
Coconino County, AZ	285,693
Greenlee County, AZ	751,619
Navajo County, AZ	487,257
Catron County, NM[a]	—
Grant County, NM	—

Source: Forest Service, 2008a

[a] Apache NF lands in Catron County are administered by the Gila NF and are not considered in this analysis.

The assumptions and additional methodology used for this analysis are described in appendix B and the “Socioeconomic Resource Report” (Forest Service, 2014c) available in the “Plan Set of Documents.”

Affected Environment

The affected environment section is split into three parts: (1) population and demographics, (2) employment and income, and (3) environmental justice.

Population and Demographics

This section highlights population and demographic trends in the study area. Population is an important consideration in managing natural resources. In particular, population structure (e.g., size, composition, density) and population dynamics (how the structure changes over time) are essential to describing the consequences of forest management and planning on a social environment (Seesholtz et al., 2004). Population increases may lead to conflicts over land use, travel management, recreation activities, and values. These are conflicts that Forest Service managers attempt to balance when making management decisions.

Population Growth

The study area counties are home to 355,064 people (U.S. Census Bureau, 2010). Table 158 displays population data for the counties, their respective states, and the Nation in 1990, 2000, and 2010.

Table 158. Population change 1990-2000 and 2000-2010

Area	1990	2000	% Growth, 1990-2000	2010	% Growth, 2000-2010
Apache County, AZ	61,591	69,423	12.7%	71,518	3.0%
Coconino County, AZ	96,591	116,320	20.4%	134,421	15.6%
Greenlee County, AZ	8,008	8,547	6.7%	8,437	-1.3%
Navajo County, AZ	77,658	97,470	25.5%	107,449	10.2%
Catron County, NM	2,563	3,543	38.2%	3,725	5.1%
Grant County, NM	27,676	31,002	12.0%	29,514	-4.8%
Study Area Total	**274,087**	**326,305**	**19.1%**	**355,064**	**8.8%**
Arizona	3,665,228	5,130,632	40.0%	6,392,017	24.6%
New Mexico	1,515,069	1,819,046	20.1%	2,059,179	13.2%
United States	248,709,873	281,421,906	13.2%	308,745,538	9.7%

Source: U.S. Census Bureau, 1990, 2000, and 2010

The data reveal substantial diversity between counties. The counties range in populations from 134,421 residents in Coconino County, AZ (which accounts for more than one-third of total study area population), to 3,725 in Catron County, NM. Both Coconino and Navajo Counties, AZ, have more than 100,000 residents; while Greenlee County, AZ, and Catron County, NM, both have fewer than 10,000 residents.

In addition to population size, the counties are diverse in terms of growth rates. All study area counties experienced population growth between 1990 and 2000. However, growth slowed between 2000 and 2010. Two counties (Greenlee County, AZ, and Grant County, NM) lost population during the latter decade. In both periods, the population growth rate in the study area was below the population growth rates in Arizona and New Mexico.

Rapid population growth may signal expanding economic opportunities and/or desirable amenities. On the other hand, slow or negative population growth may signal an aging population (deaths exceed births) and low net migration (or out-migration). Areas with large populations or rapid population growth are less likely to be acutely affected by Forest Service management, while areas with small populations or stagnant/negative growth are likely more vulnerable to Forest Service actions.

Population Density

Population density can serve as an indicator of a number of socioeconomic factors of interest: urbanization, availability of open space, socioeconomic diversity, and civic infrastructure (Horne and Haynes, 1999). More densely populated areas are generally more urban, diverse, and offer better access to infrastructure. In contrast, less densely populated areas provide more open space, which may offer natural amenity values to residents and visitors. Table 159 displays the number of people per square mile for the counties of interest.

Despite population growth in most of the counties, the number of people per square mile remains quite low. Every study area county is less dense than its respective state and the Nation as a whole. Catron County, NM, has the lowest population density, with only one person for every 2 square miles. Even the most densely populated county (Navajo County, AZ) has many fewer people per square mile than either the state (Arizona) or the Nation.

These findings suggest that most of the study area is quite rural. Low population density also points to high levels of public ownership. In all of the Arizona counties included in the analysis, a minority of the land is privately owned. Navajo County, AZ, has the highest private ownership rate, 30 percent, but the majority of land is publicly owned (Forest Service, BLM, and State lands) or Indian reservation land. In Greenlee County, AZ, only 8.1 percent of the land is privately owned, which accounts for the low population density in the county (Arizona Department of Commerce, 2008).

Table 159. Population density

Area	People/Square Mile
Apache County, AZ	6.4
Coconino County, AZ	7.2
Greenlee County, AZ	4.6
Navajo County, AZ	10.8
Catron County, NM	0.5
Grant County, NM	7.4
Arizona	56.3
New Mexico	17.0
United States	87.1

Source: U.S. Census Bureau, 2010

Age and Gender

As with other population characteristics, the median age varies substantially between counties. Apache, Coconino, Greenlee, and Navajo Counties (AZ) are all relatively young with median ages below the state and national medians. In contrast, the New Mexico counties (Catron and Grant) exceed the state and national median ages by nearly a decade in Grant County and almost 20 years in Catron County. A high median age generally indicates that a relatively large number of retirees reside in the area. An area with a large percentage of retirees earns income primarily from investments and transfer payments (e.g., dividends, Social Security), rather than salaries and wages (table 160).

Table 160. Median age

Area	Median Age
Apache County, AZ	32.4
Coconino County, AZ	31.0
Greenlee County, AZ	34.8
Navajo County, AZ	34.7
Catron County, NM	55.8
Grant County, NM	45.9
Arizona	35.9
New Mexico	36.7
United States	37.2

Source: U.S. Census Bureau, 2010, table DP-1

Age data may be relevant for forest management decisions. A population's age may affect community values and uses associated with National Forest System (NFS) lands. For example, older populations are more likely to desire easily accessible recreation opportunities.

Gender disparities in counties (i.e., deviations from a 50/50 split) may have numerous explanations, including (1) the significant presence of an industry that is often dominated by one gender (e.g., forestry or mining); (2) a large number of single-parent households; (3) a large retiree population, which due to differences in life expectancy, often leads to a higher concentration of women; and (4) a combination of the above and other unnamed factors.

Table 161 displays the gender breakdown for the study area counties, the states, and the Nation. Most of the counties have gender distributions similar to the national distribution. Greenlee County, AZ, and Catron County, NM, however, diverge from these trends. In these counties, the male population exceeds the female population by 3 percentage points or more.

Table 161. Gender distribution

Area	Females (Percent Total Population)	Males (Percent Total Population)
Apache County, AZ	50.1	49.9
Coconino County, AZ	50.4	49.6
Greenlee County, AZ	47.9	52.1
Navajo County, AZ	50.0	50.0
Catron County, NM	47.7	52.3
Grant County, NM	50.9	49.1
Arizona	50.3	49.7
New Mexico	50.6	49.4
United States	50.8	49.2

Source: U.S. Census Bureau, 2010, table DP-1

Educational Attainment

Educational attainment, the measure of people with at least a high school diploma or bachelor's degree, is an important indicator of an area's social and economic opportunities and its ability to adapt to change. Table 162 lists the percentage of the adult population with at least a high school diploma and a bachelor's degree.

Table 162. Educational attainment, percent of persons age 25 and older

Area	High School Graduate	Bachelor's Degree or Higher
Apache County, AZ	72.1%	10.3%
Coconino County, AZ	87.0%	31.1%
Greenlee County, AZ	89.8%	13.4%
Navajo County, AZ	80.5%	14.4%
Catron County, NM	86.0%	21.3%
Grant County, NM	85.3%	24.1%
Arizona	85.0%	26.3%
New Mexico	82.7%	25.5%

Source: U.S. Census Bureau, 2010, table DP02

Thirty percent of Coconino County, AZ, residents have at least a bachelor's degree, a rate that exceeds the rate in any other study area county, either state, and the Nation. Catron and Grant Counties (NM) have educational attainment rates that are comparable to state and national averages. Greenlee County (AZ) has a high percentage of high school graduates, but the percentage of adults with at least a bachelor's degree is approximately half of state and national averages. Apache and Navajo Counties (AZ) have the lowest educational attainment rates in the study area. Both counties fall below state and national educational attainment rates.

High educational attainment rates generally exist in areas with plentiful employment opportunities for working-age adults with high levels of education. The presence of highly educated adults may be self-reinforcing: a highly educated population is a signal that an area provides economic and cultural opportunities, which attracts additional college educated adults to the area. This process leads to further economic development and job creation. In contrast, areas with low levels of educational attainment are less able to adapt to economic change (Florida, 2002). Areas with lower educational attainment (i.e., Apache and Navajo Counties) are less resilient to change. As a result, land management actions are more likely to adversely affect social and economic well-being in these counties.

Forest Visitors

Table 163 reports Apache-Sitgreaves NFs visitor activity participation. Relaxing, viewing natural features, viewing wildlife, hiking/walking, driving for pleasure, and fishing are activities in which more than half of forest visitors engage. Relaxing is the most common main activity (i.e., the primary purpose of the forest visit), followed by fishing, hiking/walking, and camping in developed sites.

Table 163. Percent participation in activities and primary activities of Apache-Sitgreaves NFs' recreation visitors[a]

Activity	Percent Participation[b]	Percent Who Indicated as Primary Activity
General-relaxing, escaping noise and heat	84.2	41.3
Viewing natural features (scenery) on NFS lands	79.3	3.5
Viewing wildlife on NFS lands	73.5	1.0
Hiking or walking	62.2	8.7
Driving for pleasure on roads	53.3	3.2
Fishing-all types	50.5	19.6
Picnicking and day gatherings in developed sites	47.8	1.5
Camping in developed sites	35.7	7.2
Gathering mushrooms, berries, firewood, etc.	27.6	0.2
Primitive camping	19.4	3.3
Visiting nature center or visitor information services	18.3	0.5
Resorts and cabins on NFS lands	13.7	0.0
Bicycling, including mountain bikes	11.5	0.3
Off-highway vehicle travel	11.3	4.0

Activity	Percent Participation[b]	Percent Who Indicated as Primary Activity
Visiting historic and prehistoric sites	11.0	0.1
Other nonmotorized activities (swimming, sports)	6.9	0.9
Motorized water travel (boats, jet skis)	6.8	0.2
Nonmotorized water travel (canoe, raft)	6.4	0.0
Nature study	4.8	0.0
Backpacking and camping in unroaded areas	4.0	0.1
Horseback riding	3.4	0.4
Hunting-all types	3.0	1.3
Other motorized land/air activities (plane, other)	1.1	0.0
Downhill skiing or snowboarding	0.1	0
Snowmobile travel	0	0
Cross-country skiing, snowshoeing	0	0

[a] Kocis et al., 2002

[b] More than one activity could be checked.

Employment and Income

The previous section assessed demographic trends in the study area relative to the state and national averages. This section focuses on economic conditions and trends. This discussion provides additional information on the social and economic environment in the study area.

Per Capita Income

Per capita income is a key indicator of the economic well-being of a county. High per capita income may signal greater job opportunities, highly skilled residents, greater economic resiliency, and well-developed infrastructure. Table 164 provides data on per capita income in 2010 for the counties, states, and Nation.

Coconino County, AZ, has the highest per capita income in the study area, which is consistent with the demographic data presented above. Coconino County has the highest proportion of college-educated adults (table 162) and its population grew nearly 40 percent between 1990 and 2010 (table 158). However, all counties in the study area have lower levels of per capita income than their respective states and the Nation.

Apache and Navajo Counties (AZ) have the lowest per capita income in the study area. Per capita income in Navajo County, AZ, is approximately $10,000 less than per capita income in Arizona. In Apache County, AZ, per capita income is less than half of statewide per capita income. Apache County is the 16th poorest county in the Nation, based on per capita income (Navajo County is the 192nd poorest) (U.S. Census Bureau, 2009). The per capita income data, grouped with demographic data, suggest that many residents of Apache and Navajo Counties (AZ) are socially and economically vulnerable. This is discussed in greater detail in the Environmental Justice section.

Table 164. Per capita income in 2010 U.S. dollars

Area	Per Capita Income
Apache County, AZ	$12,294
Coconino County, AZ	$22,632
Greenlee County, AZ	$21,281
Navajo County, AZ	$16,745
Catron County, NM	$20,895
Grant County, NM	$21,164
Arizona	$25,680
New Mexico	$22,966
United States	$27,334

Source: U.S. Census Bureau, 2010, table DP03

Per capita income considers all sources of income including wages and salary payments, transfer payments, investment earnings, dividends, and rents. The poorest counties likely receive much of their income in the form of transfer payments, such as unemployment insurance and Supplemental Nutrition Assistance Program payments. These finding are borne out in the “Non-Labor Income” and “Employment” sections that follow.

Median Earnings

Per capita income offers an incomplete picture of the economic well-being of an area. Table 165 presents data on median earnings for workers. Whereas per capita income considers all sources of income; median earnings includes wage and salary earnings.

When only median earnings for workers are considered, the economic conditions in Apache and Navajo Counties (AZ) do not seem to meaningfully diverge from the rest of the counties in the study area. Comparing per capita income and median earnings data for Apache and Navajo Counties (AZ) suggests that the residents who are employed in these counties work in similarly paying occupations as residents of other study area counties, but that a smaller proportion of residents in Apache and Navajo Counties (AZ) are employed. The employment characteristics of individuals in these counties are addressed further in the two subsequent sections: non-labor income and unemployment. The higher median earnings for Greenlee County, AZ, reflect the wages paid by the mining industry.

Income and earnings data are incomplete without a discussion of cost of living. The topic is addressed further in the “Housing” section.

Table 165. Median earnings for workers in 2010 U.S. dollars

Area	Median Earnings for Workers
Apache County, AZ	$22,541
Coconino County, AZ	$22,473
Greenlee County, AZ	$35,068
Navajo County, AZ	$22,524
Catron County, NM	$24,375
Grant County, NM	$21,711
Arizona	$29,573
New Mexico	$25,115
United States	$29,701

Source: U.S. Census Bureau, 2010, table DP03

Non-Labor Income

Table 166 displays the role of labor and non-labor income in total personal income for 2000 and 2009. Non-labor income is any income derived from investments, dividends, rents, or transfer payments. In contrast, labor income is salary and wage disbursements from employment. During this past decade, the percentage of total income derived from non-labor sources increased in all considered areas.

Non-labor income is not directly tied to employment; therefore, it can be more resistant to economic downturns. However, as the most recent recession demonstrated, asset markets can be quite volatile, and non-labor income that depends on investment returns may be unstable.

An increase in non-labor income may reflect changing demographic characteristics. Older populations rely largely on non-labor income, including rents, dividends, and transfer payments (e.g., Social Security). High percentages of non-labor income likely indicate higher concentrations of retirees.

The finding that in 2009 Apache and Navajo Counties (AZ) derive more than half of total personal income from non-labor sources seems incongruent with assumption that a high percentage of non-labor income indicates a large retiree population. As table 160 shows, both Apache and Navajo Counties (AZ) have low median ages, below the state and national medians, which suggests a relatively small retiree population. However, as table 164 presents, these counties have low per capita income and table 167 shows that these counties also have the highest unemployment rates in the study area. These findings suggest that residents of these counties are dependent on government transfer payments (e.g., unemployment insurance) for income.

Table 166. Contribution of labor and non-labor income to total personal income, 2000 and 2009

Area	2000 Labor %	2000 Non-Labor %	2009 Labor %	2009 Non-Labor %
Apache County, AZ	56%	44%	47%	53%
Coconino County, AZ	64%	36%	62%	38%
Greenlee County, AZ	74%	26%	61%	39%
Navajo County, AZ	58%	42%	47%	53%
Catron County, NM	46%	54%	42%	58%
Grant County, NM	55%	45%	47%	53%
Arizona	68%	32%	62%	38%
New Mexico	66%	34%	62%	38%
United States	69%	31%	64%	36%

Source: U.S. Bureau of Economic Analysis, 2011

The high proportion (exceeding 50 percent) of non-labor income in Catron and Grant Counties (NM) is likely the result of large retiree populations. These counties have the highest median ages (table 160) in the study area. In these counties, non-labor income likely comes from both personal investments (e.g., dividends, rent) and government transfers (e.g., Social Security).

The distribution of labor and non-labor income in Coconino and Greenlee Counties (AZ) mimics the state and national distributions.

Unemployment

The unemployment rate provides insight into the correspondence between residents' skills and employment opportunities. The "natural" rate of unemployment is said to be around 5 percent. This is the so-called "natural" rate because this is a level that allows for movement between jobs and industries, but it does not signal broad economic distress. Recently, the national unemployment rate has hovered between 9 and 10 percent. Table 167 provides the 2010 annual unemployment rate for the U.S., Arizona, New Mexico, and the study area counties.

As suggested above, the discrepancies between per capita income and median earnings in Apache and Navajo Counties (AZ) can be partially explained by high unemployment rates in these counties. Apache and Navajo Counties (AZ) had the highest unemployment rates among study area counties, and they exceeded state and national rates. As a result, many residents in Apache and Navajo Counties (AZ) likely rely on unemployment insurance and other transfer programs targeting low-income individuals and families. The other counties have unemployment rates that are closer to state and national rates.

Table 167. Unemployment rate, 2010 annual, not seasonally adjusted

Area	Unemployment Rate
Apache County, AZ	16.4%
Coconino County, AZ	8.9%
Greenlee County, AZ	11.1%
Navajo County, AZ	15.7%
Catron County, NM	9.5%
Grant County, NM	10.9%
Arizona	10.0%
New Mexico	8.4%
United States	9.6%

Source: U.S. Bureau of Labor Statistics, 2011

Housing

The above comparisons of per capita income and median earnings between the study area, states, and the Nation are incomplete. Data on local cost of living offer additional context. Of the contributions to cost of living, housing costs are among the most substantial. Table 168 presents median home values in 2010. Except for Coconino County (AZ), the study area counties have relatively low home values, below state and national medians. Therefore, although income is low in many study area counties, they also have relatively low living costs.

Table 168. Median value of owner-occupied homes in 2010 U.S. dollars

Area	Median Home Value
Apache County, AZ	$80,900
Coconino County, AZ	$257,700
Greenlee County, AZ	$65,800
Navajo County, AZ	$134,300
Catron County, NM	$129,400
Grant County, NM	$125,000
Arizona	$215,000
New Mexico	$158,400
United States	$188,400

Source: U.S. Census Bureau, 2010, table DP04

Economic Diversity

Economic diversity generally promotes stability and offers greater employment opportunities. Highly specialized economies (i.e., those that depend on very few industries for the bulk of employment and income) are prone to cyclical fluctuations and offer more limited job opportunities. Determining the degree of specialization in an economy is important for decisionmakers, particularly when the dominant industry can be affected by changes in policy. For Forest Service responsible officials, this is likely to be the case where the forest products industry or the tourism and recreation industries, for instance, are reliant on the local national forests.

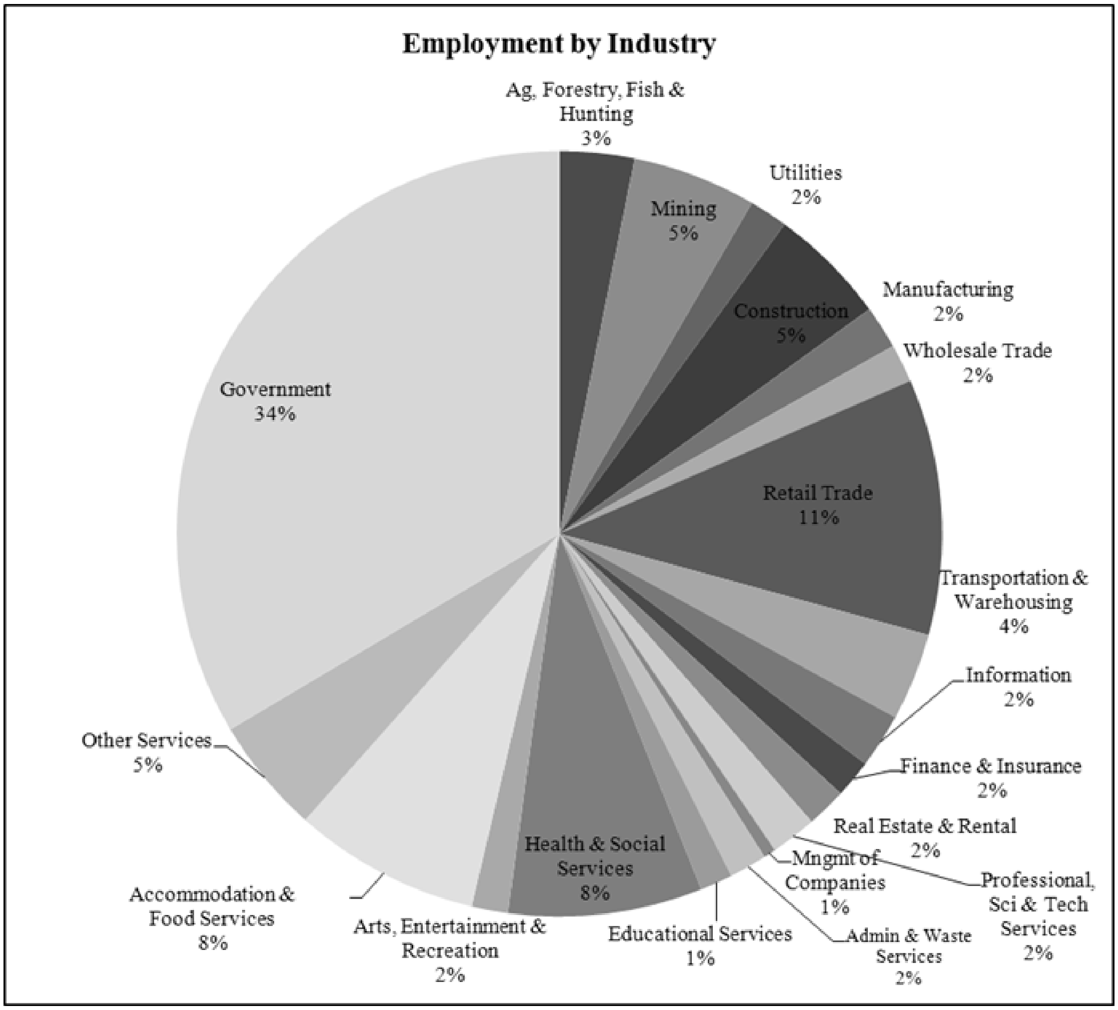

Figure 81. Employment by industry in the study area (MIG, 2009)

Figure 81 provides a breakdown of employment by industry in the study area. Government is the dominant sector: approximately one-third of the area jobs are in government. Retail trade, health and social services, and accommodation and food services each account for at least 8 percent of local employment. These industries are consistent with findings discussed in the demographic section: namely, a substantial government presence due to public land management, a retiree population that consumes health and social services, and amenities that attract tourists who support the retail trade and accommodation and food services sectors.

Figure 82 provides the employment specialization index (ratio of the percent employment in each industry within the study area to an average percent of employment in that industry for the State of Arizona). Within the agriculture sector (3 percent of study area employment), commercial logging accounts for 35 percent of employment and 29 percent of output, while cattle ranching accounts for 28 percent of employment and 40 percent of output (MIG, 2009). Both of these activities occur on the forests.

Whereas figure 81 considers the study area in isolation, figure 82 compares industry concentration in the study area to the state as a whole. The numbers on the x-axis of figure 81 show the degree of specialization in the local economy. A score of one indicates that the study area and the state (Arizona) are equally specialized in the sector. A score above one indicates that the study area is more specialized in the sector than the state. A score below one indicates that the study area is less specialized in the sector than the state.

As the two figures demonstrate, these two methods of data analysis suggest quite different results. Mining accounts for 5 percent of employment in the study area, a relatively modest figure until it is put in the context of the state. A resident of study area is nearly 10 times more likely to be employed in the mining sector compared to residents of Arizona as a whole. Similarly, although government employment dominates in figure 81, the study area is only somewhat specialized in government employment compared to the state. Across Arizona, government employment provides a substantial percentage of total employment. Public lands (e.g., national forests, national parks, BLM-managed public lands, state-owned lands), military installations, and tribal lands are common across the state. All of these features, in addition to the large share of state and local government employment, contribute to a sizable government presence in Arizona. The large role that government plays in the Arizona economy makes it more likely that Forest Service decisions would affect economic activity and well-being. Since the study area is specialized in economic sectors that have direct links to public lands, particularly mining and agriculture, forestry, fishing and hunting, Forest Service management actions may have a more pronounced economic influence relative to an area with smaller natural resource sectors.

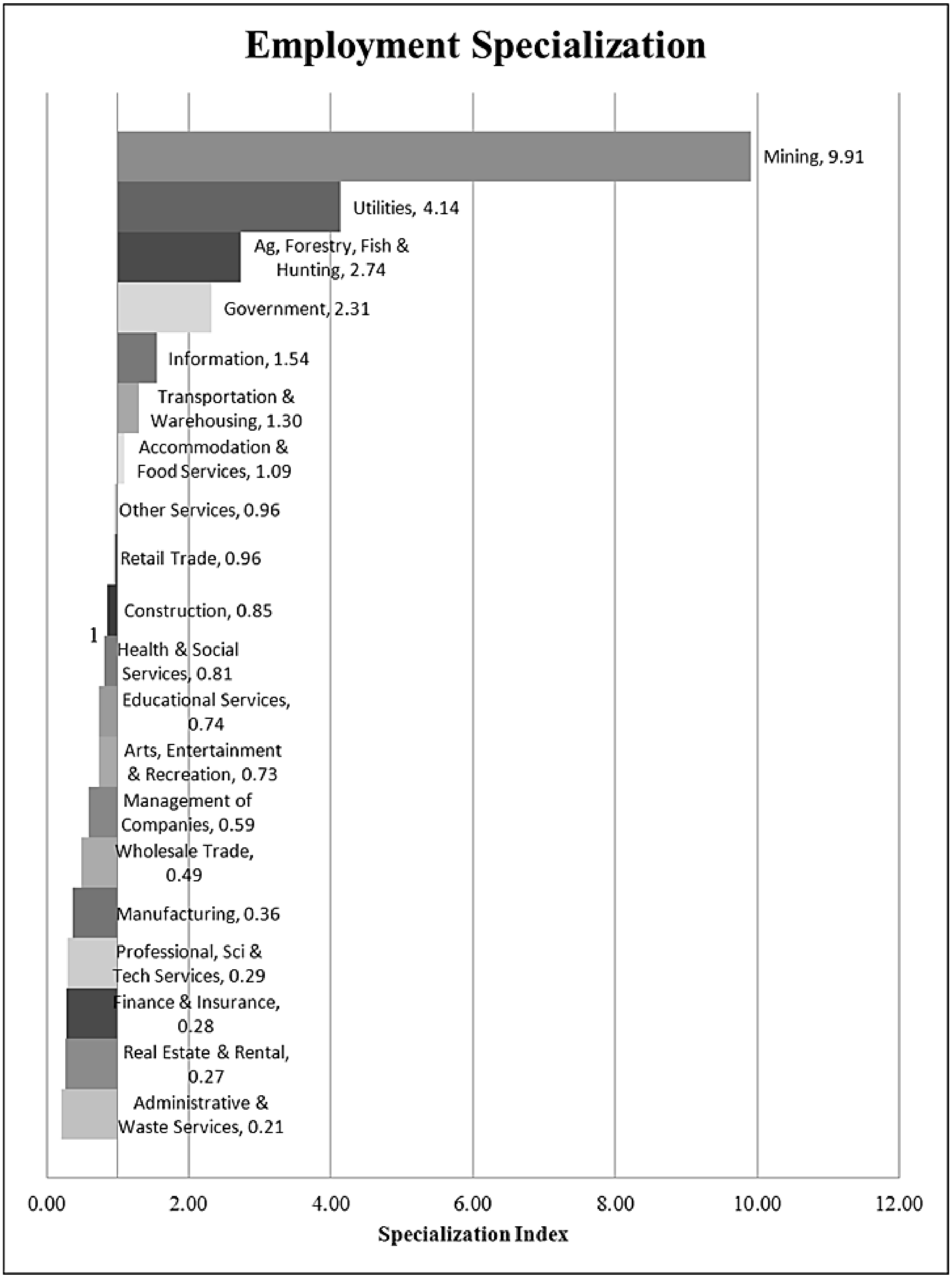

Figure 82. Employment by specialization (MIG, 2009)

Payments to States and Counties

As mentioned previously, the forests encompass approximately 2.1 million acres of eastern Arizona. The Forest Service makes payments to states and counties that contain NFS lands. These payments fall into two categories: Payments in Lieu of Taxes (PILT) and Secure Rural Schools and Community Self-Determination Act payments (SRSCS). Table 169 displays the payments to counties from the Apache-Sitgreaves NFs.

Federal agencies do not pay property taxes; therefore, PILT is distributed to counties to compensate for the local services that support activities on Federal lands, such as law enforcement and road maintenance.

SRSCS payments are intended to improve public schools, maintain infrastructure, improve the health of watersheds and ecosystems, protect communities, and strengthen local economies.

Table 169. Payments to states and counties from the Apache-Sitgreaves NFs

Area	SRSCS (FY2009)	PILT (FY2010)	Total FS Payments
Apache County, AZ	$1,373,662	$1,183,201	$2,556,863
Coconino County, AZ	$392,119	$94,408	$486,527
Greenlee County, AZ	$903,978	$625,620	$1,529,598
Navajo County, AZ	$1,626,447	$274,601	$1,901,048
Total	**$4,296,206**	**$2,177,830**	**$6,474,036**

Source: Forest Service, 2010g and DOI, 2010

Environmental Justice

In 1994, President Clinton issued Executive Order 12898. This order directs Federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agency decisionmakers to identify impacts that are disproportionately high and adverse with respect to minority and low-income populations and identify alternatives that would avoid or mitigate those impacts. Environmental justice, minority, minority population, low-income population, and human health and environmental effects are defined in the "Glossary."

The emphasis of environmental justice is on health effects and/or the benefits of a healthy environment. The Council on Environmental Quality (CEQ) has interpreted health effects with a broad definition: "Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low-income communities, or Indian Tribes…when those impacts are interrelated to impacts on the natural or physical environment" (CEQ, 1997).

According to U.S. Census data reported in table 170, study area counties differ substantially in their racial and ethnic composition.

Table 170. Race and ethnicity by counties, states, and Nation

Area	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino[a]
Apache County, AZ	23.3%	0.2%	72.9%	0.3%	0.0%	1.3%	2.0%	5.8%
Coconino County, AZ	61.7%	1.2%	27.3%	1.4%	0.1%	5.2%	3.1%	13.5%
Greenlee County, AZ	77.2%	1.1%	2.3%	0.5%	0.1%	15.0%	3.8%	47.9%
Navajo County, AZ	49.3%	0.9%	43.4%	0.5%	0.1%	3.4%	2.5%	10.8%
Catron County, NM	89.8%	0.4%	2.7%	0.2%	0.0%	3.8%	3.1%	19.0%
Grant County, NM	84.9%	0.9%	1.4%	0.4%	0.1%	9.6%	2.8%	48.3%
Arizona	73.0%	4.1%	4.6%	2.8%	0.2%	11.9%	3.4%	29.6%
New Mexico	68.4%	2.1%	9.4%	1.4%	0.1%	15.0%	3.7%	46.3%
United States	72.4%	12.6%	0.9%	4.8%	0.2%	6.2%	2.9%	16.3%

Source: U.S. Census Bureau, 2010, Table DP-1

[a] Hispanic or Latino ethnicity may be of any race

Apache and Navajo Counties (AZ) have very high concentrations of American Indian residents (73 and 43 percent, respectively). The Navajo Nation and the Fort Apache Indian Reservation are in both counties. The Hopi Indian reservation is in Coconino and Navajo Counties (AZ). Coconino County, AZ, also has a relatively large percentage (27 percent) of American Indian residents, resulting from the five reservations that exist in the county. Forty-three percent of the land in the study area is Native American land (Forest Service, 2009a). Grant County, NM, and Greenlee County, AZ, have higher percentages (48 percent in each county) of Hispanic/Latino residents than Arizona (30 percent), New Mexico (46 percent), and the Nation (16 percent).

Table 171 lists the poverty rates for the counties, states, and Nation. Apache and Navajo Counties (AZ) have the highest percentage of residents living in poverty. As with much of the other social and economic data presented for these counties, this finding suggests that Apache and Navajo Counties may be particularly vulnerable to changes that could affect livelihoods.

Apart from Apache and Navajo Counties (AZ), the study area counties have poverty rates that are roughly consistent with state and national rates. As of 2009, Apache County, AZ, has the 35th highest poverty rate in the Nation (U.S. Census Bureau, 2009).

Table 171. Percent of persons living in poverty

Area	Poverty Rate
Apache County, AZ	34.4%
Coconino County, AZ	18.6%
Greenlee County, AZ	13.5%
Navajo County, AZ	24.4%
Catron County, NM	15.3%
Grant County, NM	14.8%
Arizona	15.3%
New Mexico	18.4%
United States	13.8%

Source: U.S. Census Bureau, 2010, table DP03

Based on the minority status and poverty data presented above, Apache and Navajo Counties (AZ) appear most at risk for environmental justice issues. However, even in counties with relatively small minority populations and low poverty rates, disproportionate impacts to vulnerable groups may occur. The impact analysis considers the potential for Forest Service management actions to adversely affect all area residents, with a particular attention to any potential disproportionate impacts on minority and/or low-income residents.

Environmental Consequences of Alternatives

Economic Impact Analysis

Economic impact analysis estimates the employment and labor income consequences of forest management actions. Table 172 provides employment estimates by alternative. Table 173 provides labor income estimates by alternative. These tables are referenced in the alternative-specific descriptions of economic impacts.

Data on use levels under each alternative were collected from the forests' resource specialists. In most instances, the precise change is unknown. Therefore, the changes are based on the professional expertise of the forests' resource specialists (1982 Planning Rule, 219.12(g)).

Regional economic impacts are estimated based on the assumption of full implementation of each alternative. The actual changes in the economy would depend on individuals taking advantage of the resource-related opportunities that would be supported by each alternative. If market conditions or trends in resource use are not conducive to developing some opportunities, the economic impact would be different than estimated here.

Wood products jobs, labor income, revenues, and present net value (table 172, table 173, table 175, and table 176) are shown as ranges for **alternatives B, C, and D** because low and high mechanical treatment acres were modeled (see table 3, chapter 2). Mechanical vegetation treatment acres also vary by alternative theme (most acres cut in **alternative C**, followed by **alternatives B, D, and A**). **Alternatives A and B** use a mix of mechanical and wildland fire to accomplish restoration treatments, while **alternative C** emphasizes mechanical treatments and **alternative D** uses primarily wildland fire treatments. Acres that are mechanically treated (cut) result in wood products that could be offered to individuals and local and regional markets (see table 150 for wood product volumes) and would affect the number of jobs created, labor income created, and NFS program expenditures and revenues.

Across many program areas, the employment estimates do not vary substantially between alternatives. Changes in forest product removal drive most of the expected difference in employment between alternatives, with **alternative C** offering the highest expected wood products-related employment.

Although recreation management emphasis varies between alternatives, **none of the alternatives** is expected to change the economic impact of recreation. The alternatives may change how and where people choose to recreate (e.g., an increase in one type of activity and a decrease in another) but none of the changes are expected to lead to a net economic change. However, changes in recreation management emphasis may have social consequences that are not captured in employment and income data. The possible social consequences are discussed later in this document.

Table 172. Employment by program area by alternative

Program Area	Number of Jobs Contributed			
	Alt. A	Alt. B	Alt. C	Alt. D
Recreation	2,939	2,939	2,939	2,939
Grazing	120	120	120	120
Minerals	0	0	0	0
Wood Products	287	113–511	164–1,113	60–198
Payments to States and Counties	58	58	58	58
FS Expenditures	364	364	364	364
Total	**3,768**	**3,594 – 3,992**	**3,645 – 4,594**	**3,541 – 3,679**

Source: IMPLAN, 2009

As with the employment estimates, labor income is not expected to differ substantially between alternatives. Most of the difference is driven by wood products-related labor income, which is estimated to be highest under **alternative C** due to greater volumes of forest product removal.

Table 173. Labor income by program area by alternative

Program Area	Labor Income Contributed			
	Alternative A	Alternative B	Alternative C	Alternative D
Recreation	$86,629,000	$86,629,000	$86,629,000	$86,629,000
Grazing	$1,296,000	$1,296,000	$1,296,000	$1,296,000
Minerals	$19,000	$19,000	$19,000	$19,000
Wood Products	$9,562,000	$3,757,000 - $17,010,000	$5,454,000 - $37,035,000	$2,011,000 - $6,597,000
Payments to States and Counties	$2,588,000	$2,588,000	$2,588,000	$2,588,000
FS Expenditures	$17,520,000	$17,520,000	$17,520,000	$17,520,000
Total	**$117,614,000**	**$111,809,000 - $125,062,000**	**$113,506,000 - $145,087,000**	**$110,063,000 - $114,649,000**

Source: IMPLAN, 2009

Alternatives A and B would support approximately the same employment and income in the local economy. **Alternative C** would support the highest levels of Forest Service related employment and income in the local economy. **Alternative D** would support the lowest levels of employment and income in the local economy.

Financial Efficiency Analysis

Financial efficiency analysis compares forest expenditures and revenues throughout the life of a land management plan. Present net value (PNV) is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decisionmaking process. PNV combines benefits and costs that occur at different times and discounts them into a sum. A positive PNV indicates that the alternative produces more than one dollar of value (revenues) for each dollar spent (expenditures). Financial efficiency analysis is not intended to be a comprehensive analysis that incorporates monetary expressions of all benefits and costs. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited financial efficiency framework.

Table 174 presents annual forest expenditures, by program area. These figures are based on average expenditures over the three fiscal years (FY2007 to FY2009). Only the wood products expenditures are expected to vary in **alternatives C and D** because of the greater and lesser, respectively, amounts of mechanical vegetation treatments proposed.

Table 174. Annual Apache-Sitgreaves NFs program expenditures by alternative

Program Area	Alternative A	Alternative B	Alternative C	Alternative D
Grazing	$470,000	$470,000	$470,000	$470,000
Recreation	$1,371,000	$1,371,000	$1,371,000	$1,371,000
Minerals	$105,000	$105,000	$105,000	$105,000
Wood Products	$1,335,000	$1,335,000	$1,602,000	$1,068,000

Table 175 shows annual forest revenues by program area. Where available, these figures are based on average revenues over three fiscal years (FY2007 to FY2009). When 3 years of data were unavailable, the most recent year has been used. The wood products estimates are based on average inflation adjusted wood products values per CCF. Grazing and mineral revenues are not expected to vary by alternative; there are no foreseeable changes. The only factor that could change grazing revenue is if the charge per HM or AUM is increased or decreased; however, that figure is set at the national level and is beyond the control of the Forest Service. Recreation revenues are not expected to change because most of this money is associated with recreation special use permits. The large campgrounds on the Apache-Sitgreaves NFs are under permit to concessionaires, with fees generally offset by maintenance of and improvements to the facilities. The wood products revenue figures are based on the outputs from the vegetation modeling.

Table 175. Annual Apache-Sitgreaves NFs program revenue by alternative

Program Area	Alternative A	Alternative B	Alternative C	Alternative D
Grazing	$175,500	$175,500	$175,500	$175,500
Recreation	$152,049	$152,049	$152,049	$152,049
Minerals	$15,963	$15,963	$15,963	$15,963
Wood Products	$722,382	$260,999 - $1,255,757	$380,434 - $2,689,133	$143,017 - $791,053

Table 176 lists present net value (PNV) by program area and alternative. PNV is the difference between program revenues (benefits) and program expenditures (costs). The annual expenditures presented in table 174 were summed over 15 years using a 4 percent discount rate (so that one dollar today is valued higher than one dollar in 10 years). The sum of the discounted annual expenditures represents the present value of costs. The same exercise was conducted using the annual program revenues presented in table 175. The sum of the discounted annual revenues represents the present value of benefits. The difference between the present value of costs and the present value of benefits is present net value. The higher the present net value, the more financially efficient the alternative. For example, **alternative B** has a total PNV of approximately negative $20 million which is higher than the negative $27 million in **alternative A**.

The range of values in the PNV (table 176) in the **action alternatives** reflects the range between the high and low mechanical treatment objectives. **Alternative A** is based on the average mechanical treatment objective.

The differences in PNVs between **alternatives** arise primarily from changes in the expected volume of forest product removal from the Apache-Sitgreaves NFs (table 150). The wood products-related revenues and expenditures vary by alternative because of the different vegetation treatment acres.

Table 176. Present net value (PNV) by alternative and program area[a]

Program Area	Alternative A	Alternative B	Alternative C	Alternative D
Grazing	($3,568,865)	($3,568,865)	($3,568,865)	($3,568,865)
Recreation	($14,771,720)	($14,771,720)	($14,771,720)	($14,771,720)
Minerals	($1,078,985)	($1,078,985)	($1,078,985)	($1,078,985)
Wood Products	($7,423,943)	($13,015,166) – ($960,299)	($14,803,410) – $13,174,304	($11,209,304) – ($3,356,152)
Total PNV	**($26,843,513)**	**($32,434,737) – ($20,379,869)**	**($30,987,371) – ($3,009,657)**	**($33,628,874) – ($22,775,722)**

Source: QuickSilver Version 6, 2010

[a] Figures in parentheses indicate a negative number.

The expected value (average) PNV of **alternative A** would be approximately equivalent to the PNV of **alternative B**. Therefore, these alternatives are expected to be similar in financial efficiency. The potential PNV range of **alternative C** would be much greater than the range of PNVs under the **other alternatives** due to the large difference between high and low treatment objectives. The expected value PNV of **alternative C** would be the highest (most financially efficient) of any considered alternative. The expected value PNV of **alternatives A, B, and D** is approximately equivalent.

Social Consequences

Area residents and visitors attach numerous values to the Apache-Sitgreaves NFs. For some, NFS lands provide economic opportunities in rural communities. To others, the forests are valued for leisure. This binary classification ignores the nuances of peoples' values. Furthermore, many individuals are likely to rely on the forests for both economic opportunities and leisure pursuits.

The "Economic and Social Sustainability Assessment" (Forest Service, 2009a) identified social values associated with the Apache-Sitgreaves NFs, including (1) preservation of open space; (2) protection of ecosystem service and other forest-related amenity values; (3) economic opportunities from both commodity and non-commodity sources; (4) accessible and varied outdoor recreation opportunities; and (5) traditional tribal uses, such as gathering boughs and visiting sacred sites. Wood products management and lands recommended for wilderness are the main sources of potential social and economic consequences between alternatives.

As the "Affected Environment" section describes, the study area has very low population density, relatively low earnings and income, high dependence on transfer payments, and an economy dominated by government employment. These factors suggest that Forest Service decisions, and other Federal actions, may have a substantial effect on social and economic well-being in the study area. The range of employment and labor income consequences (presented in table 164 and table 165) do not differ dramatically; based on the ranges, it is possible that the **action alternatives** would provide equivalent levels of employment and income. However, **alternative C** has the highest expected values of employment and income. For individuals who primarily value the forests for economic opportunities, **alternative C** is likely to be favored. **Alternative A** is expected to provide the second-highest levels of employment and labor income to the local economy, followed by **alternative B** and then **alternative D**.

Individuals who value resource protection above resource use are likely to derive benefit from the recommendation of additional lands for wilderness, regardless of intention to recreate in wilderness. Under current management (**alternative A**), approximately 1.5 percent of visits to the Apache-Sitgreaves NFs are to designated wilderness (Forest Service, 2001). Although wilderness visits account for a relatively small percentage of total visits, wilderness also has non-recreation values, such as ecosystem services. **Alternative D** is expected to appeal to people and groups who seek additional primitive recreation opportunities and/or the protection of forest resources. **Alternatives A, B, and C** are less likely to be favored among individuals who primarily value resource protection and wilderness recreation opportunities.

Recreation management emphasis varies between alternatives. While the economic impact analysis finds no change resulting from recreation management emphasis changes, social consequences are expected. **Alternative C** emphasizes motorized and developed recreation opportunities, and therefore is likely to provide the most value to individuals who participate in motorized recreation activities. There would also be decreases in nonmotorized and dispersed recreation opportunities that could displace users to other areas or result in fewer users who prefer those types of recreation. **Alternative D**, with a greater emphasis on nonmotorized and dispersed recreation opportunities, may attract those who prefer nonmotorized and/or dispersed recreation activities, while not encouraging those with motorized/developed preferences. Therefore, recreation management emphasis would lead to distributional consequences related to visitor satisfaction and quality of life related to forest leisure activities.

Alternatives B and C would increase vegetation treatment. Increases in prescribed burns would create the potential for social consequences related to smoke emissions. Language barriers make communicating about prescribed burn plans more difficult, which can reduce the ability of individuals to engage in behaviors to avoid smoke. Nonnative English speakers and recent immigrants may be unable to understand or know where to find information about planned prescribed burns or other Forest Service activities that may affect their communities. Individuals who are sensitive to smoke, children, the elderly, asthmatics, and those with illnesses, would be most affected by the increase in smoke from prescribed burns.

The environmental justice analysis finds that the study area has large percentages of American Indian and Hispanic/Latino residents as well as high poverty rates. These findings raise the likelihood of observing disproportionate adverse effects to low income and/or minority residents. However, analysis of the decisions to be made under the alternatives finds no environmental justice consequences. Since **all alternatives** would continue to support similar levels of employment and income, none of the decisions is expected to exacerbate the poverty rate or disproportionately worsen the economic well-being of low-income individuals. Under **all alternatives**, American Indian residents would be able to gather forest products and visit sacred sites. **None of the alternatives** is expected to disproportionately adversely impact racial and/or ethnic minority individuals.

Recreation

Approximately 2.1 million visitors recreate on the forests annually. These visitors support approximately 2,939 (full- and part-time) jobs and $86.6 million in labor income in the local economy on an average annual basis. None of the decisions to be made in **all alternatives** is expected to change the economic impact of recreation. The social impact of recreation, including consumer surplus (the value of recreation above what is paid for the experience), is discussed above. The number of recreation visits is expected to increase by 3 percent annually as a result of outside factors. The management decisions to be made may affect the recreation opportunities. Recreation participation may change as a result of population growth, demographic change, and recreation preferences (e.g., a growth in OHV use). None of these trends is expected to be affected by Forest Service management decisions.

Minerals

Stone, sand, and gravel are removed from the forests. The quantities removed are not expected to differ between **all alternatives**. Since most of the firms that extract stone, sand, and gravel exist outside of the IMPLAN study area (ADMMR, 2007), the extraction of minerals from the forests is not expected to support employment and income in the local economy. However, these activities would have economic impacts outside of the study area.

Grazing

Under **all alternatives,** grazing would support approximately 120 jobs and $1.3 million in labor income, annually. However, these figures assume that available animal unit months (AUMs) are fully utilized. Based on current use levels, approximately 66 jobs and $713,000 in labor income are supported by grazing on the forests.

The benefit to permittees of public forage, below the market price, is approximately $994,500. The average private land grazing fee per AUM in Arizona is $9, compared to the $1.35 public land grazing fee (USDA NASS, 2011). If the forests' grazing permittees had to replace their public land forage with private land forage, the annual cost of grazing would be $1,170,000 (130,000 AUMs at $9 per AUM). With Forest Service forage, permittees pay $175,500 (130,000 AUMs at $1.35 per AUM). Therefore, the economic benefit to ranchers is not fully captured in the employment and labor income figures presented above. However, the surplus to the ranchers can also be seen as a cost to providers of private forage.

Wood Products

The number of jobs and labor income supported by the availability of forest products can be found in table 164 and table 165. **Alternative C** would provide the highest number of wood products jobs and income, followed by **alternatives B and A**. **Alternative D** would provide the smallest number of wood products jobs and income.

Cumulative Environmental Consequences

The geographic scope for the social and economic cumulative environmental consequences analysis is the six-county region[45] identified in the affected environment section. This analysis considers how past, present, and reasonably foreseeable future actions on lands throughout the region may interact under **all alternatives** to affect the social and economic environment. The social and economic analysis of **all alternatives** is unique among the resources and uses in that

[45] Apache, Navajo, Coconino, and Greenlee Counties in Arizona and Catron and Grant Counties in New Mexico.

the effects occur primarily off the forests. In this way, the indirect effects described above are cumulative in nature; they evaluate the effects of **all alternatives** both on and off the Apache-Sitgreaves NFs. However, the indirect effects analysis does not address how actions taken on adjacent lands affect the social and economic consequences of **all alternatives**.

All alternatives emphasize ecosystem restoration. Current and proposed activities on adjacent NFS lands also emphasize ecosystem restoration. The scale of the proposed treatments (on the Apache-Sitgreaves NFs and adjacent lands) is expected to draw new forest product harvesting and processing firms to the region. The wood products and ecosystem restoration estimates presented in the environmental consequences section are based on a static model of the economy. However, if additional firms locate in the area because of regionwide restoration efforts, the local economic impact of activities under **all alternatives** would increase.

The recreation-related effects identified in the social and economic environmental consequences section may be influenced by trends and activities that occur off the forests. In fiscal year 2010, Arizona State Parks closed 13 of its 28 parks. Although most of these parks have reopened, a number are open on a reduced schedule. Lyman Lake, the only state park in Apache County and 30 miles north of the forests, is open on a reduced schedule through local partnerships. Furthermore, the possibility of future closures remains because of ongoing budget uncertainty. The reduction of recreation opportunities in local state parks may slightly increase demand for recreation on the forests. **All alternatives** support diverse recreational opportunities on the forests. Increased recreation use of the Apache-Sitgreaves NFs would lead to a slightly higher economic impact than predicted in the indirect effects discussion. However, other adjacent lands (BLM, NPS, other NFS lands, and undeveloped state lands) continue to provide recreation opportunities.

Under **all alternatives**, portions of the Apache-Sitgreaves NFs may provide a corridor to support reasonably foreseeable alternative energy development in the region. This could facilitate alternative energy development in the region, which would support local area employment.

Other Required Disclosures

The regulations for implementing NEPA at 40 CFR § 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with … other environmental review laws and executive orders.” As a proposed Federal project, the proposed plan decisions are subject to compliance with other Federal and State laws. Throughout the development of the proposed plan, there has been collaboration and cooperation with various State and Federal agencies. The following actions have been taken to document and ensure compliance with laws that require consultation and/or concurrence with other Federal agencies.

- **Endangered Species Act, Section 7**: Consultation with the U.S. Fish and Wildlife Service, regarding federally listed threatened, endangered, and proposed species and designated and proposed critical habitat, is in progress. Biological assessments (BAs) for fisheries and wildlife have been prepared for the preferred alternative and submitted to the U.S. Fish and Wildlife Service for consultation according to the ESA.
- **National Historic Preservation Act**: Consultation with the Arizona State Historic Preservation Officer (SHPO) has been conducted as mandated by Section 106 of the National Historic Preservation Act. The Southwestern Region also subscribes to a

programmatic agreement with SHPO for ways in which consultation can be conducted. The various appendices of the programmatic agreement are particularly directed to Southwestern Region projects and issues.